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MONITORING OF DOWNSTREAM SALMON AND STEELHEAD AT FEDERAL HYDROELECTRIC FACILITIES - 1998

Annual Report 1998

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MONITORING OF DOWNSTREAM SALMON AND STEELHEAD AT FEDERAL HYDROELECTRIC FACILITIES - 1998

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Abstract.— 1998 marked the first year of smolt monitoring in the new Smolt Monitoring Facility (SMF) at John Day Dam. The difference in sample collection is dramatic. Prior to 1998, samples were collected from one or two of 48 gatewells. Samples in the new facility are collected near the outfall sight of the bypass channel, effectively sampling from all 48 gatewells. Even though sample numbers can be somewhat controlled by adjusting the sample rate, sampling at the minimum sample rate during the peak migration times still yielded sample numbers almost double those of 1997. Collection and index numbers this year were the highest ever recorded at JDA. Migration conditions were excellent in 1998 with manageable flows and very little debris in the river. Dissolved gas levels were generally below the Oregon and Washington water quality standards. Migration timing was similar to last year for yearling chinook, wild and hatchery steelhead. Subyearling chinook, coho, and sockeye all had shorter middle 80% passage durations. Descaling and mortality rates were among the lowest ever recorded at John Day, and in some cases, were the lowest. The PIT tag detection aspect of the facility also worked well jumping from a previous high of 3,784 detections to 49,615 detections this year.

At Bonneville Dam, sampling was much more like previous years. Sample numbers were the lowest since 1986, collection numbers were higher than last year, and the total index number was the lowest since 1991. River conditions were similar to those described for JDA, manageable with little debris. Passage timing was similar to last year for all species except sockeye, for which the middle 80% passed Bonneville in 20 days compared to 48 days last year. Peak passage for spring migrants occurred in May with one exception, a coho peak in early June. Descaling and mortality were comparable to previous years. PIT tag detection was up to 43,131 from 25,507 last year.

PREFACE

Project 84-014 has been part of the annual integrated and coordinated Columbia River Basin Smolt Monitoring Program since 1984, and currently addresses measure 5.9A.1 of the 1994 Northwest Power Planning Council's (NPPC) Fish and Wildlife Program. The program is coordinated by the Fish Passage Center and funded by the Bonneville Power Administration. This National Marine Fisheries Service (NMFS) project was established to: 1) collect and report daily fish capture, fish condition, dam operations, and river flow data to water managers to improve the scientific information on which to base in–season operations of the hydrosystem, and 2) analyze the collected data and characterize juvenile fish passage at mainstem federal dams and transfer this information, learning, and understanding to the fisheries community through technical reports and publications. In the 1980s, this project conducted the smolt monitoring at Lower Granite, Lower Monumental, McNary, John Day, and Bonneville dams. Since the early 1990s, the smolt monitoring at the Snake River dams and McNary Dam has been assumed by non-federal entities, mainly the states of Washington and Oregon, and this project has performed the smolt monitoring at John Day, The Dalles (1989 – 1991), and Bonneville dams.

The following report presents results from the 1998 smolt monitoring at John Day and Bonneville dams and represents the fifteenth annual report under this project. The report also contains summaries of data for all years of the program at John Day and Bonneville dams in Appendices C and D.

INTRODUCTION

The seaward migration of juvenile salmonids was monitored by the National Marine Fisheries Service (NMFS) at Bonneville Dam, located at river mile 145, from 9 March to 31 October and at John Day Dam, located at river mile 216, from 8 April to 29 October, 1998 (Figure 1). The NMFS Smolt Monitoring Project is part of a larger Smolt Monitoring Program (SMP) coordinated by the Fish Passage Center (FPC) for the Columbia Basin Fish and Wildlife Authority. This program is carried out under the auspices of the Northwest Power Planning Council's Fish and Wildlife Program and is funded by the Bonneville Power Administration.

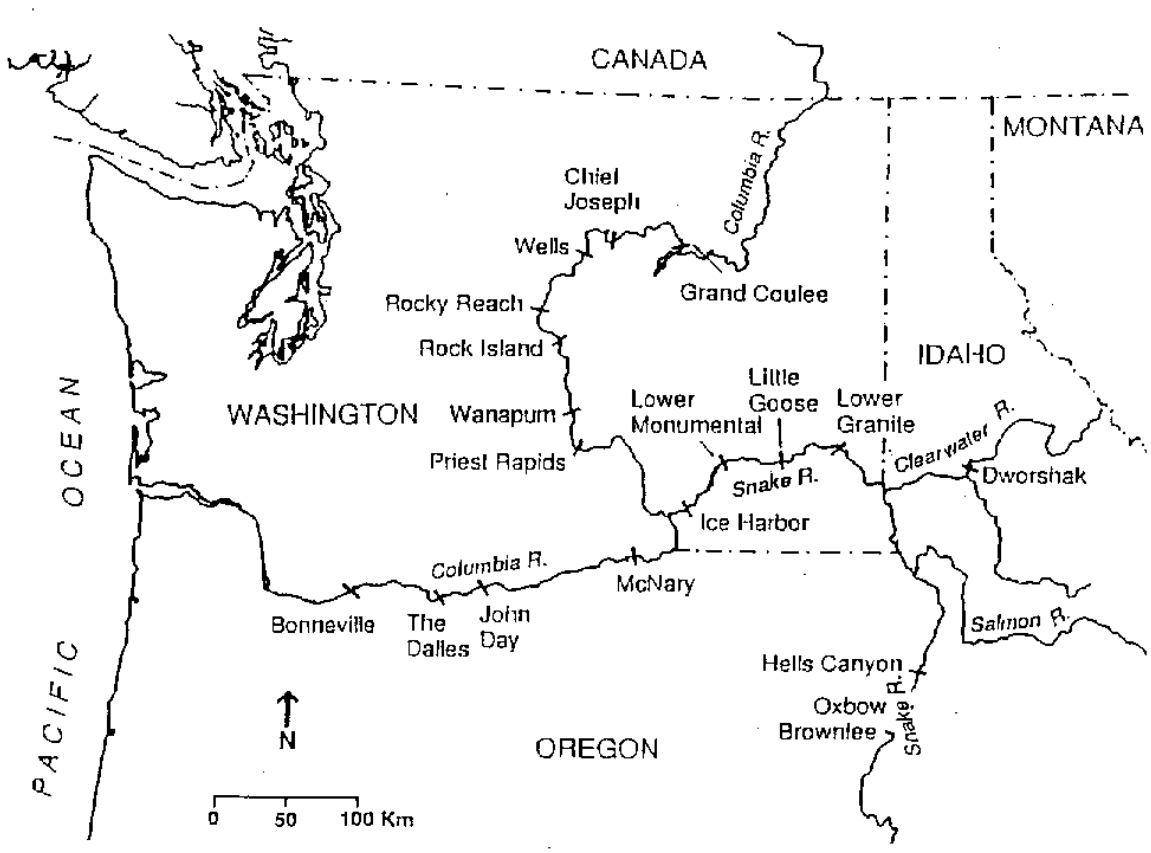

Figure 1. Hydroelectric projects on the Snake and Columbia Rivers, including the two smolt monitoring sites operated by the National Marine Fisheries Service, Bonneville and John Day dams. This figure is reprinted courtesy of NMFS-Northwest Fisheries Science Center-Graphics Department.

The purpose of the SMP is to monitor the timing and magnitude of the juvenile salmonid out-migration in the Columbia basin and make flow and spill recommendations designed to facilitate fish passage. Data are also used for travel time and survival estimates and to build a time series data set for future reference. The purpose of the NMFS portion of the program is to provide the FPC with species and project specific real time data from John Day and Bonneville dams.

METHODS AND MATERIALS

JOHN DAY DAM

Sampling

At John Day in 1998, sampling commenced on 9 April and ended on 29 October. Sampling was conducted from

0700-0700, seven days a week. Each sample day was divided into four sample periods. Fish collected during the first (0700-1400), second (1400-2000), and fourth (0300-0700) sample periods were processed at the end of their respective collection periods. During the third (2000 to 0300) period, when the majority of the fish pass through the bypass system, fish were processed hourly to minimize delay. At the end of the sample day, the total of the four sample periods comprised the daily count.

This year (1998) was the first year of sampling in the newly constructed Smolt Monitoring Facility (SMF) (Figure 2). Prior to 1998, samples were collected from one or two of 48 gatewells with an airlift pump system of the type described by Brege et al. (1990). Through 1994, all fish collected were sampled. In 1995, subsampling was introduced to reduce the number of fish handled. Subsample rates were 25%, 33%, and 50%. The new SMF is equipped with a state of the art 3-way rotational gate. When the gate rotates left, all fish are diverted into the sample building holding tank. The center flume serves as a bypass in which fish are returned to the river via the juvenile outfall. When the gate rotates right, fish are diverted into the PIT tag flume and one of two PIT tag holding tanks. Immediately upstream of the 3-way rotational gate, all fish are interrogated for PIT tags. The sample rate and number of diversions per hour were entered into a computer that controls the 3-way rotational gate. Adjustments were entered at the top of the hour for consistency and fish collected at different sample rates were kept separate. Samples were taken 2-6 times per hour depending on the sample rate, which ranged from 0.67% to 25%. During the spring, with more species present, the target sample range was 750-1000 fish. During the summer/fall migration, with mainly subyearling chinook present, the target sample range was 350-500 fish. Sample rates were adjusted as needed to achieve these target sample sizes. For a complete summary of sample rates and target estimates, see Table C-10.

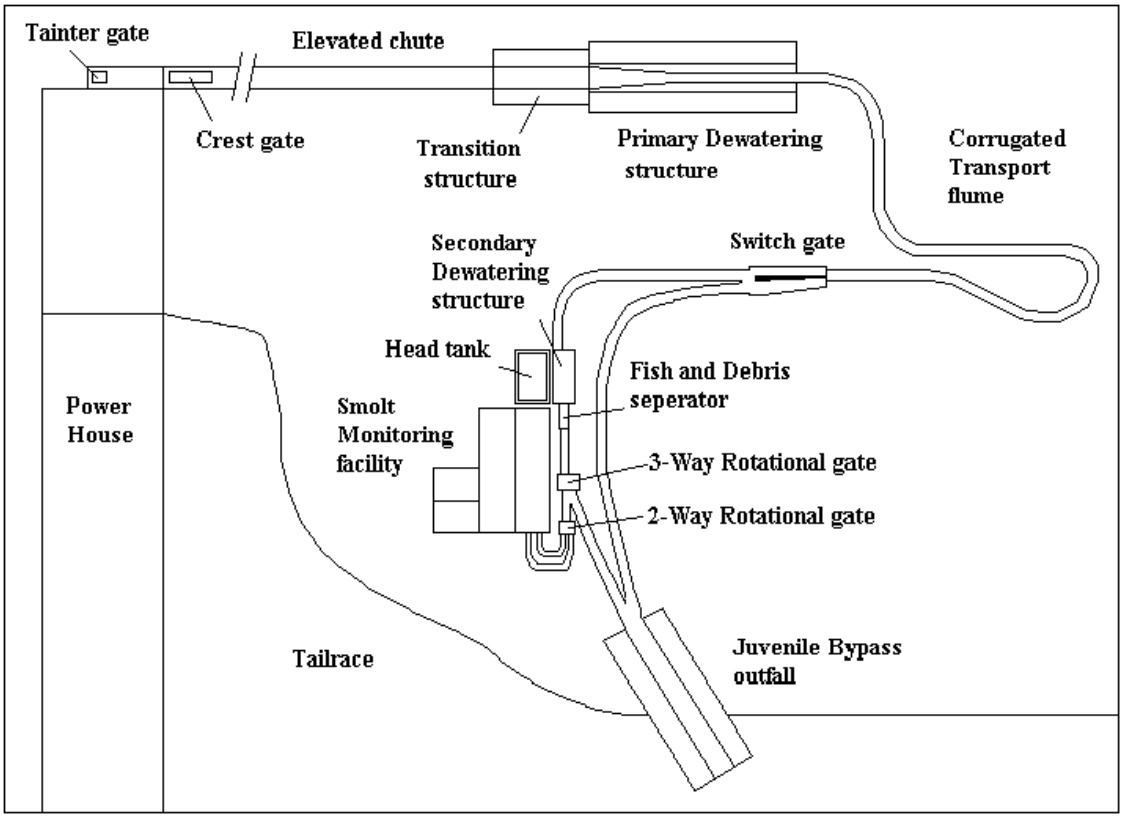

Figure 2. Diagram of the Smolt Monitoring Facility at John Day Dam, 1998.

Fish were collected in a 6,796-liter (1,795 gal) holding tank located inside of the sampling lab. At the end of a sample period, the crowder was moved forward and the next sample was collected behind it. Approximately 50-75 smolt at a time were then crowded into a 20 by 24-inch pre-anesthetic (PA) chamber using a panel net. The water level in the PA chamber was lowered to about 8 inches (48 liters) and fish were anesthetized with MS-222 at a concentration of about 51 mg/L. Once anesthetized, fish were gravity fed via a 6 inch PVC pipe, onto a final dewatering screen and into the examination trough that contained about 36 mg/L of MS-222 to minimize stress

during examination. A recirculating system was used to minimize MS-222 usage and a chiller kept examination trough water temperature consistent with river water temperature. Following examination, all sampled fish were gravity fed via a 4 inch PVC pipe to a 2,726 liter (720 gal) recovery tank and held for a minimum of twenty minutes before being returned to the bypass system. All holding and recovery tanks had a constant exchange of river water. Diagrams showing the location of equipment in the wet lab and the components of the facility are presented in Figure A-1.

BONNEVILLE DAM

Smolt monitoring began on 9 March and concluded on 31 October in powerhouse 1 (PH1), while in the second powerhouse (PH2), condition monitoring and PIT tag interrogation commenced on 1 April and ended on 2 October. Fish samples were collected from the bypass channels of the first and second powerhouses using the downstream migrant trap in the first powerhouse and the modified (for PIT tag interrogation) collection equipment in the second powerhouse. Gessel (1986) described the trap operation for the first powerhouse and Krcma et al. (1984) described the previous system operation for the second powerhouse. The current system in the second powerhouse is described below.

First Powerhouse

Sampling effort in PH1 remained at 8 hours per day in 1998. Samples were collected hourly, from 1600 to 2400 hours, seven days per week. The sample rate was adjusted on an hourly basis from 30 seconds to 15 minutes per hour (0.83% - 25%). Sample time was split into two samples of equal duration per hour, except during periods of high passage, when only one sample of 30, 36, 48, or 72 seconds was taken. Samples were collected by lowering a wedge wire screen into the bypass channel at the end of the inclined screen, diverting fish into a 2,415 liter (638 gal) tank suspended in the downwell (Figure 3). Collected fish were drained from the tank to a stainless steel holding tank via a rectangular chute. Fish were then net transferred from the holding tank to the sorting trough, which contained about 42 mg/l of Finquel (MS-222) to anesthetize the fish and 15 ml (0.16 mg/l) water conditioner (PolyAqua). After processing, sampled fish passed through a tunnel PIT tag detector/diverter system before emptying into a recovery tank. PIT tagged fish were diverted to a separate tank so condition data could be collected. Fish were allowed to recover before releasing them into the Juvenile Bypass System (JBS) via a 6 inch PVC pipe. A diagram of the PH1 sampling area is presented in Figure B-1.

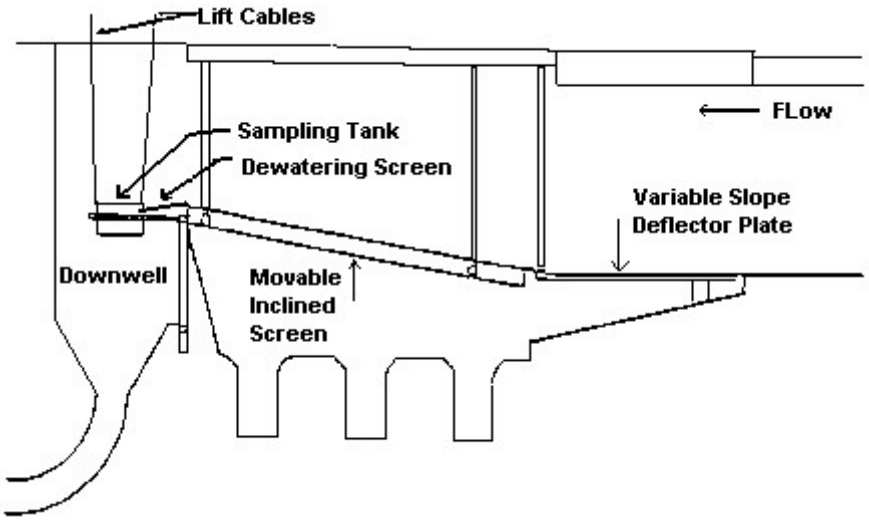

Figure 3. Inclined screen sampling system in the bypass channel of the first powerhouse at Bonneville Dam.

Flat Plate Operation

The flat plate was operated concurrent with sampling (1600-2400 hours), from 9 March through 31 March, and again from 20 September through 31 October. Between those dates, when fish passage was higher, the flat plate was operated 24 hours per day. Although the flat plate system was designed for unmanned operation, personnel

were present 24 hours per day. These personnel were needed to monitor channel water level, maintain the flat plate at the proper level with respect to the channel level, conduct efficiency tests, and transmit PIT tag data. The flat plate antennae system consists of two detection coils, each sealed in individual watertight casings. The cases were fitted in a frame mounted on top of the collection tank and attached with a pivoting arm in each corner. A pneumatic cylinder was used to raise or lower the flat plate system. Between samples, the flat plate was lowered onto the tank and the tank was lowered to sampling position. When the screen was lowered, fish passing over the flat plate were scanned for PIT tags. For sample collection, the flat plate was raised and fish were diverted into the collection tank.

Second Powerhouse

The PIT tag interrogation system at PH2 operated 24 hours per day from 1 April to 19 September. From 19 September through 4 October the PIT tag interrogation system was only operated from 1600 to 2400 hours. This system was installed in 1997 for The Dalles Spillway Survival Study conducted by NMFS. It was designed to provide full bypass channel PIT tag interrogation and to collect fish. The collection system was operated as needed to get the target number of research fish, up to 5000 per day. Those fish were then PIT tagged, transported to The Dalles Dam, and released. Detection of those PIT tagged fish at Bonneville formed the basis of the results. The system worked by lowering a wedge wire dewatering screen into the flow at the end of the bypass channel, directing some flow and all fish onto a set of separator bars (Figure B-3). Adults passed across the wetted separator bars and returned to the JBS. Juvenile fish dropped through the wetted separator bars into a flume. The flume lead to a series of 2-coil detectors that controlled a two way diverter which directed the fish either to the Fingerling Experimental Research Laboratory (FERL) or back to the river (Figure B-4). The fish diverted to the FERL entered a modified wet separator through an upwell and exited through a 4 inch pipe leading to holding raceways. Collected fish accumulated in the raceways until the sample target had been reached. To process, fish were crowded to the end of the raceway and preanesthetized before being transferred to a 40 liter (10.5 gal) aluminum trough containing river water and MS-222 at a concentration of 42 mg/L. Target species were routed to tagging stations, non-target species were transferred to a 178 liter (178 gal) aluminum recovery tank via a 4 inch PVC pipe. After recovery for approximately 30 minutes, fish were returned to the JBS through a 4 inch PVC pipe, collection pool, and conduit. Tagged fish were routed to transportation tanks.

Samples for condition monitoring were obtained from fish collected on Monday, Wednesday, and Friday. When the researchers were tagging, condition samples were taken from their fish. If they weren't tagging fish, a separate sample was collected, as in past years. A subsample of one to three hundred fish was examined for descaling, mortality, and for the presence of brands and tags. After examination, fish were allowed to recover and were released into the JBS. A diagram of the PH2 sampling area is presented in Figure B-2. Detailed diagrams of the PIT tag system at PH2 are shown in Figures B-3, and B-4. Monitoring personnel were required around the clock for cleaning and data management.

JOHN DAY AND BONNEVILLE

Subsampled Fish Condition

Detailed fish condition monitoring was performed on a target sample size of 100 individuals per species, three days a week. Steelhead and sockeye were examined Tuesday, Thursday, and Saturday whereas chinook and coho were examined Monday, Wednesday, and Friday. The sample crews attempted to choose fish at random and to select fish throughout the sample day. In addition to fin clips and marks (brands or tags), smolts were examined for descaling, injuries to the head and body, parasites, disease, and signs of predation. Fork lengths were also recorded so that length averages could be calculated for all subsampled fish. At John Day, condition data was collected from 9 April to 12 June for yearling chinook, steelhead, coho, and sockeye while subyearling chinook were examined 12 June to 1 October. Bonneville condition data was collected from 15 April to 12 June for yearling chinook, steelhead, coho, and sockeye while subyearling chinook were examined from 3 June to 2 September.

Gas Bubble Trauma Subsampling

From 6 April through 29 August, 100 fish per day were examined for the presence of gas bubbles. Examinations were performed on unpaired fins, eyes, and the lateral line using a variable magnification (6X to 40X) dissecting microscope. Steelhead and the most abundant chinook, yearling or subyearling, were examined on alternating days. Bubbles found in the lateral line were quantified as the percent of the lateral line occluded and assigned a ranked designation. If less than 5% of the lateral line was occluded, a rank of 1 was assigned. A rank of 2 was used for the 6% - 25% range, rank 3 for the 26% - 50%, and a rank 4 for greater than 50%. The same ranking system was used

for the percent of surface area covered by bubbles for the unpaired fins.

Performance Monitoring
Tests to evaluate species identification, brand recognition, descaling assessment, and data recording accuracy of SMP personnel were conducted during the migration season. A subsample of ten fish were randomly selected, anesthetized, and placed into a compartmentalized divider located in the sorting trough. Fish were processed independently and specific details were recorded for each fish including: 1) species, 2) adipose clip, 3) level of descaling, and 4) presence of external marks or tags. Coworkers then compared records and if discrepancies were present, they were discussed and agreements were reached. This approach has several advantages over previously used methods, including: 1) increased frequency of tests, 2) up to three people are able to test concurrently, 3) promotes teamwork and builds consistency between coworkers, and most importantly, 4) the ability to discuss discrepancies with fish in hand.

Data Collected
Items 1-5 were reported to the Fish Passage Center daily; item 6, the PIT tag data, was reported to the PTAGIS data center daily or weekly, depending on the type of PIT tag data, as indicated below:

1) Species specific hourly and daily sample totals
2) Brands and fin clips
3) Descaling and mortality
4) Species specific length and condition data (subsampling only)
5) River, powerhouse, turbine, and spill flow data
6) PIT tag detection (daily) and recapture condition data including: length, weight, and overall condition (weekly)

DEFINITION OF TERMS

Three types of numbers are discussed in the report, defined as follows:

1) Total Sample: actual fish counts, number of fish handled.

2) Estimated Collection: total sample number divided by sample rate, resulting in an estimated number of fish passing through collection system.

3) Fish Passage Indices: estimated collection counts divided by the proportion of total river flow passing through the sample system resulting in a relative indicator of fish abundance with no adjustment for Fish Guidance Efficiency, horizontal, vertical or temporal fish distribution.

As stated in the Fish Passage Center Annual Reports, Fish Passage Indices (FPI) are used as relative indicators of population abundance, and assumes that fish pass through spill and powerhouse units in numbers proportional to the flow through those passage routes. Indices are not estimates of total daily passage, but rather a relative measure of how the migration is progressing over the season for a given species.

In the past, both sites have generated hourly and daily indices, and these numbers are still listed in some of the historical tables in Appendices C and D, so they are defined as follows:
Hourly Resolution FPI divides hourly collection counts by the proportion of river flow through the sampled unit or powerhouse for that hour, then sums hourly subtotals to get the daily total. There is no expansion for 8 hour monitoring at Bonneville.

Daily Resolution FPI divides daily collection counts by the proportion of daily average river flow through the sampled unit (JDA) or powerhouse (BO1) for the day.

RESULTS AND DISCUSSIONS

JOHN DAY DAM

Included in this year's report is a program summary table. It includes sample dates, sampling effort, sample, collection, and index numbers for each year of sampling at John Day Dam. The table is located on page 53.

The Numbers

Sample Numbers

The total number of fish handled at John Day in 1998 was 83,311 (Table 1), a 178% increase over the 1997 total of 46,876, the lowest sample number ever recorded from smolt monitoring at John Day (Table C-10). Species specific sample numbers expressed as a percent of 1997 sample numbers are as follows: wild sockeye, 853%; yearling chinook, 605%; wild steelhead, 209%; coho, 156%; subyearling chinook, 152%; hatchery sockeye, 91%; and hatchery steelhead, 46%. See Table 1 for the actual numbers and Table C-10 for a comparison to previous years. Two possible explanations for the increase in sample numbers are lower levels of spill attracting fewer fish to that passage route leaving more to pass through the bypass system; and sampling from the entire bypass system resulting in more fish even at the minimum sample rate than would have been sampled at the minimum rate with the airlift.

The largest change in sample composition was seen in yearling chinook, comprising 33% of the samples in 1998 and only 10% in 1997. The second largest change was for hatchery steelhead, going down from 29% last year to just 8% this year. Comparisons for other species are as follows, with 1998 percentages listed first: yearling chinook, 37%/44%; wild steelhead, 10%/9%; coho, 6%/7%; sockeye, 5%/2 %.

Collection Estimates

The total collection estimate of 3,756,312 is larger than all but one of the previous Fish Passage Indices (1995) and probably the result of the improved sampling method, from the entire bypass channel rather than a single gatewell. The magnitude of difference is remarkable, almost 50 times greater than last year's collection estimates and almost 11 times greater than the largest collection estimate recorded at John Day (Table C-10). All species showed a tremendous increase in collection numbers, ranging from a 286-fold increase for sockeye to a 14-fold increase for hatchery steelhead. Collection estimates for the remaining species, expressed as number of times greater than the 1997 estimate, are as follows: wild steelhead, 40; yearling chinook, 100; subyearling chinook, 65; and coho, 56.

Fish Passage Indices

Collection numbers are divided by the proportion of river flow through the sample unit, which in 1998 was the powerhouse, not Unit 3, to get a Fish Passage Index (FPI). The 1998 index total for all species combined was 5,489,754, the largest index ever recorded at John Day and about 3.5 times greater than the 1997 Daily FPI of 1,541,288. This does not necessarily indicate an increase in the number of migrating salmonids. More likely it is the result of a new sampling method that produces a more accurate index, combined with less spill than the previous two years, resulting in more fish being guided into the bypass system. A breakdown by species for sample, collection, and index numbers can be found in Table 1 and a comparison of 1998 numbers to all previous years in Table C-10.

River Conditions

River Flow

The 1998 spring (April & May) river flow averaged 263.3 kcfs, substantially lower than the 414.4 kcfs for the same period last year. The spring peak flow of 435.4 kcfs occurred on 31 May and was about 100 kcfs smaller than last years 20 May peak of 539.8 kcfs but nearly identical, in size and timing, to the 1996 peak of 432.8 kcfs on 31 May. For June, July, and August, river flow averaged 217.8 kcfs. Flows dropped rapidly over the first two weeks of June, going from 424.9 kcfs on 1 June to 225.9 kcfs on 17 June. For the remainder of June and through August, flows fell gradually, ending the month at 112 kcfs. For September and October, flows ranged between 83 kcfs and 152.7 kcfs, averaging 106.3 kcfs (Figure 5).

Table 1. Summary of 1998 smolt monitoring at John Day and Bonneville dams.

Species	Site	Sample		Collection[1]		FPI[2]	Descaling[3]		Mortality[4]	
		Number	Percent Comp.	Number	Percent Comp.		#	%	#	%
Yearling	John Day	27,732	33.3	758,689	20.2	1,147,861	1,675	6.1	133	0.5
Chinook	Bonneville PH #1	6,847	13.3	97,569	12.3	346,259	337	4.9	20	0.3
	Bonneville PH #2	3355	27.8	-----		-----	146	4.4	9	0.3
Subyearling	John Day	31,178	37.4	1,584,083	42.2	2,155,479	676	2.2	70	0.2
Chinook	Bonneville PH #1	30,828	59.8	450,622	56.7	1,591,831	485	1.6	127	0.4
	Bonneville PH #2	5,282	43.8	-----		-----	50	1.0	22	0.4
Wild	John Day	8,378	10.1	296,969	7.9	455,339	132	1.6	4	0.0
Steelhead	Bonneville PH #1	2,587	5.0	40,862	5.1	159,916	56	2.2	1	0.0
	Bonneville PH #2	695	5.8	-----		-----	23	3.3	2	0.3
Hatchery	John Day	6,214	7.5	408,195	10.9	634,446	444	7.2	16	0.3
Steelhead	Bonneville PH #1	3,294	6.4	57,078	7.2	237,299	208	6.3	5	0.2
	Bonneville PH #2	720	6.0	-----		-----	38	5.3	2	0.3
Coho	John Day	5,330	6.4	370,277	9.9	572,762	297	5.6	9	0.2
	Bonneville PH #1	6,272	12.2	121,695	15.3	513,643	176	2.8	2	0.0
	Bonneville PH #2	1,303	10.8	-----		-----	75	5.8	9	0.7
Wild	John Day	4,263	5.1	322843	8.6	500,115	686	16.2	16	0.4
Sockeye	Bonneville PH #1	1497	2.9	24,124	3.0	102,960	274	18.3	3	0.2
	Bonneville PH #2	659	5.5	-----		-----	74	11.2	0	0.0
Hatchery	John Day	216	0.3	15256	0.4	23,751	40	18.8	1	0.5
Sockeye	Bonneville PH #1	240	0.5	2,839	0.4	11,604	25	10.5	3	1.3
	Bonneville PH #2	52	0.4	-----		-----	6	11.5	0	0.0
SEASON	John Day	83,311		3,756,312		5,488,770	3,950	4.8	249	0.3
TOTALS	Bonneville PH #1	51,565		794,789		2,963,511	1,561	3.0	161	0.3
	Bonneville PH #2	12,066		-----		-----	412	3.4	44	0.4

[1] Collection numbers are sample numbers divided by sample rate.

[2] FPI (Fish Passage Index) is collection divided by the proportion of daily average river flow through the powerhouse

[3] Descaling numbers are based on sample numbers minus mortality numbers

[4] Mortality numbers are based on sample numbers.

Spill and Dissolved Gas

Lower river flows in 1998 resulted in less spill volume overall, but nearly equal proportions of total river flow were spilled for the last two years. Spill, expressed as a percent of total river flow, averaged 27% in April and May (spill for juvenile migration began 20 April) compared to 30.6% for the same period last year. Throughout the rest of the spill program, spill averaged about 27% of river flow the last two years. Accordingly, dissolved gas levels were also lower this year, averaging 116% in the John Day tailrace for April and May compared to 129% last year. For the rest of the spill program for juveniles, June through August percent saturation in the tailrace averaged 112.5% in 1998 and 122% in 1997. These levels of spill enabled the total dissolved gas limits imposed by the Washington and Oregon water quality departments to generally be maintained. For more detail on dissolved gas levels and

monitoring results, see the Fish Passage Center annual report.

Temperature
Spring water temperature in the fish handling facility ranged from 47.3^0F to 58.3^0F and averaged 53.8^0F. During June and July the range was 56.2^0F to 75^0F with an average of 66.1^0F. In August and September, the range was 68.2^0F to 76^0F, the highest temperature of the year recorded on 14 August. The average for this late summer period was 72.2^0 F.

Passage Patterns
Seasonal
The relative run timing (10, 50, and 90% passage dates) and the duration of the middle 80% (in days) for 1998 are compared to the median dates and presented in Figure 4. Median dates were calculated from the daily indices. Prior to 1990, wild and hatchery stocks were not differentiated. Compared to historical medians, the 10% passage dates were earlier or the same for all species except coho. The 90% passage dates were also very similar for all spring migrants, with the greatest difference being for hatchery steelhead, resulting in the middle 80% of the run taking 6 days longer to pass John Day Dam (Figure 4). For subyearling chinook, the 10% passage date was the same as the median but the 90% passage date was 18 days earlier.

When 1998 passage is compared to 1997, the 10% and 90% passage dates for yearling chinook, wild and hatchery steelhead occur a few days later in 1998 than in 1997, but their middle 80% passage durations are very similar. Subyearling chinook, coho, and sockeye all have much shorter middle 80% durations in 1998 than in 1997 (Figure C-2, Table C-2).

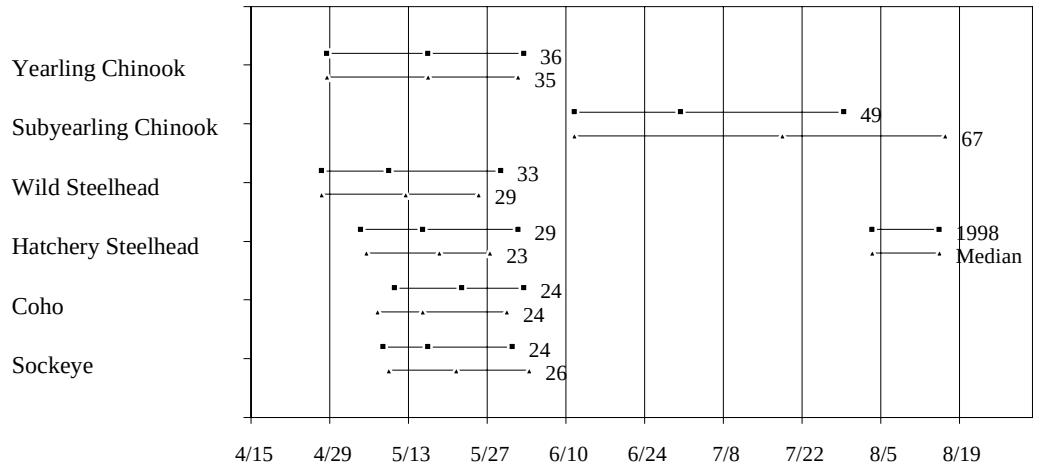

Figure 4. 10%, 50%, and 90% passage dates and the historical median at John Day Dam, 1998. The duration between the 10% and 90% passage dates is indicated for each line.

Yearling chinook passage began increasing the last week of April and continued through May. Passage peaked on 2 June at about 9% of the season total, corresponding with a seasonal peak in river flow (Figure 5). Wild and hatchery steelhead and sockeye passage peaked during the second week of May. Steelhead and sockeye were present in the samples until mid June. Coho had two distinct passage peaks, the first on 22 May and the second on 2 June. The latter coincided with the yearling chinook peak and the seasonal high flow period. Subyearling chinook passage was highest in the last week of June and first week of July. The daily percent of seasonal passage was below 3% for the rest of the season.

The average passage pattern for all species with the standard deviation for each day, are presented in Figure C-1. Wild steelhead show the most variability around the beginning and end of the migration, while the other stocks showed more variance around the peak of the migration.

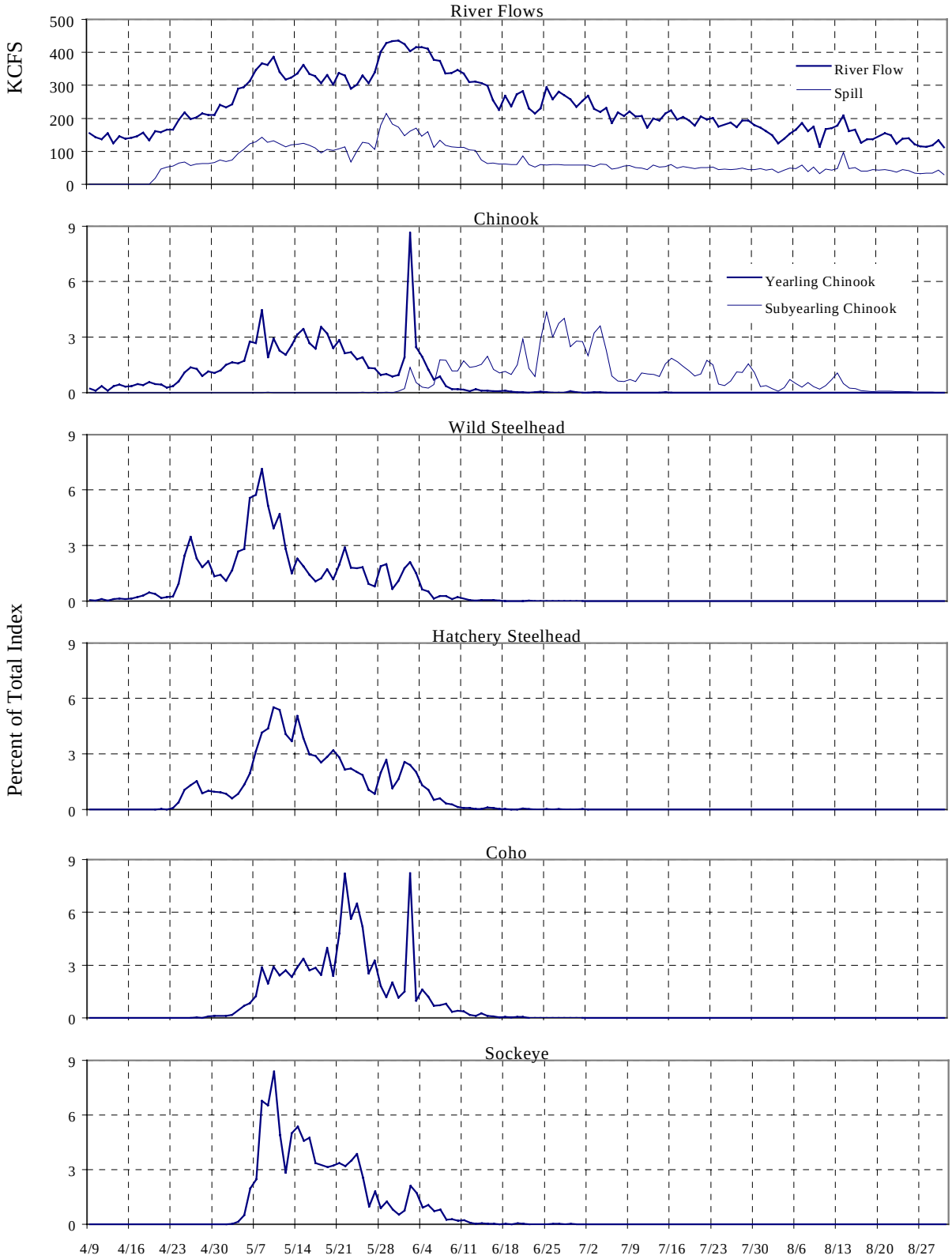

Figure 5. Seasonal passage and daily average river flows for John Day Dam, 1998.

Diel

With the relocation of sampling to the new smolt monitoring facility in 1998, the collection of the hourly passage detail was discontinued. However, the diel data collected between 1985 and 1997 is presented several ways in Appendix C. Table C-1 presents the total percent of night passage by species for each year. Figure C-3 is a graphical presentation of the diel pattern for all years, averaged and presented with standard deviation for each hour. Figure C-4 shows the percent of night passage as a bar graph for each year and species, with the average for each species shown as a line. Table C-3 shows the percent of total passage each year by hour, for each species.

Fish Condition

Descaling in 1998 was lower than last year and the historical average for all species except sockeye, which was lower than last year but higher than the historical average. Moderate flows in 1998 helped to keep the debris load to a minimum, which in turn reduced the risk of injury and/or descaling. The largest decline in descaling from last year to this year was for yearling chinook, going from 19.1% to 6.1% (Figure 6).

Descaling for yearling chinook increased as the season progressed, with the seasonal peak (24%) on 16 May, and smaller peaks on 4 and 6 June of 17% and 21%, respectively (Figure A-2). For the season, yearling chinook descaling averaged 6.1%, among the lowest of rates recorded for that species at John Day. Wild steelhead had two main descaling peaks, one on 13 May at 12% and the other on 31 May at 11% (Figure A-2). The seasonal average was the lowest ever recorded for this species at John Day at just 1.6% (Table C-4 and Figure C-5). Hatchery steelhead descaling was frequently over 10% (Figure A-2) and averaged 7.2% for the season which was the second lowest ever recorded at John Day. Coho descaling fluctuated around the 5% rate all season, resulting in an average of 5.6%. The peak was on 31 May at 18.6%.

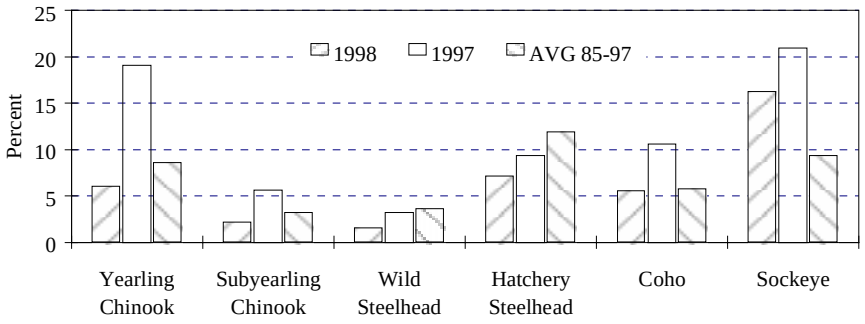

Figure 6. Total descaling for 1998, compared to 1997 and to the 85-97 average at John Day Dam.

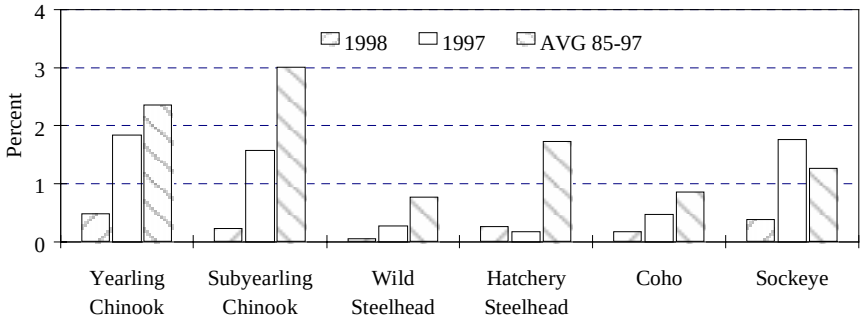

Figure 7. Total mortality for 1998, compared to 1997 and to the 85-97 average at John Day Dam.

Sockeye descaling was highly variable from day to day, routinely fluctuating between 15% and 25%, and occasionally dipping to 5% or climbing to 35%. The seasonal average was 16.3%, the third highest and well above the historical average of 10.1%. Subyearling chinook descaling seldom exceeded 5% (Figure A-3) and averaged just 2.2% for the season, slightly better than the historical average of 3.3%. Historical descaling and mortality data are presented in Table C-4 and Figure C-5.

Mortality rates in 1998 were lower than last year and the historical average for all species, except one, hatchery steelhead was slightly higher than last year (Figure 7). In fact, with very few exceptions, 1998 mortality rates were the lowest on record for John Day, with all species at or below 0.5% (Figure 7, Figure C-6, and Table C-4).

Subsampled Fish Condition

In 1998, 13,634 smolts were examined for detailed condition information. Partial descaling (3-19% on one side) in 1998 was lower for all species than in 1997, ranging from 3.6% for wild steelhead to 15.5% for sockeye. Percent reductions for partial descaling ranged from 5% (8.1% to 7.7%) for subyearling chinook to 60.5% (14.9% to 5.9%) for coho. Hatchery steelhead had the highest incidence of operculum damage at 2.3%, which is 0.2% lower than last year. Again, as in past years, the incidence of attempted bird predation was much higher on hatchery steelhead (7.6%) than any other species (0.2% - 1.8%). All species exhibited a significant reduction in the frequency of body injuries in 1998. Hatchery steelhead had the highest incidence at 0.5%, down from 2.8% observed in 1997. The number of parasites on wild steelhead increased slightly (0.2%) in 1998 to 2.4%. Columnaris infection in subyearling chinook was down from 0.9% last year to just 0.1% this year. See Methods section for a complete list of possible conditions and techniques. For a historical summary of condition subsampling results, see Table C-5.

Gas Bubble Trauma Monitoring

A total of 8,567 smolts were examined for Gas Bubble Trauma symptoms in 1998. Of those, 102 fish (1.2%) showed symptoms of gas bubble trauma, primarily bubbles in the unpaired fins (86.8%) (Table A-3). For discussion purposes, since such a high percentage of bubbles were seen in the unpaired fins, and 84% were of rank 1 or 2, all observations were lumped together. Hatchery steelhead had the highest incidence at 3.7%, followed by yearling chinook at 1.5%. The majority of the symptoms observed in yearling chinook (92.5%) were found during the months of May and June. Of the 3,474 subyearling chinook examined, 17 (less than 0.5%) had bubbles. The majority of all symptoms in all species were found in May and June (86.3%). This coincided with the peak spill periods, which occurred around the last week of May. By July, spill was greatly reduced and very few bubbles (11 or 0.45%) were found in the 2,574 fish examined in July and August. See the Fish Passage Center annual report for more details and a graphic presentation of results.

Length Averages

Since high percentages (70-85%) of outmigrating smolts are of hatchery origin, length data are primarily a function of smolt size at the time of release. However, graphing the data does show relative size differences and trends throughout the season. Hatchery steelhead were consistently the largest fish sampled until early June. Subyearling chinook increased in size as the season progressed and all other species varied (Figure 8).

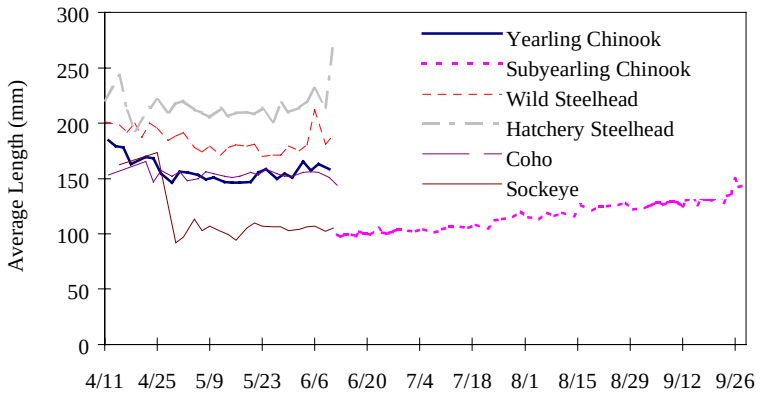

Figure 8. Average length of juvenile salmonids at John Day Dam, 1998.

PIT Tags and External Marks

Passive Integrated Transponder (PIT) Tags

Total PIT tag detections went from 928 in 1997 to 49,615 in 1998. This is approximately 53 times the number of PIT tags detected in 1997, and 13 times the number detected in 1996 (Table C-6). Interrogation of all fish passing through the bypass channel in 1998, rather than from gatewell 3B only in 1997, or 3B and 3C as in 1996, resulted in this large increase. A summary (by species, run, and rearing type) of the PIT tags detected at John Day for 1998 can be found in Table A-1.

Freeze Brands

A total of 84 freeze brands were observed in 1998, about 5 times the number of freeze brands seen in 1997. All were on hatchery steelhead from 1 of 4 release sites, see Table A-2 for details. See Table C-7 for a summary of brands per year by species, which shows the declining use of freeze brands.

Elastomer Tags

One of the more popular tags replacing freeze brands is the elastomer tag. These are small pieces of colored plastic which are injected into tissue posterior of the eye. A total of 849 elastomer tags were recorded this year. Table A-2

contains details for these marks.

Performance Monitoring

Personnel

Numerous tests were conducted in 1998 to evaluate employee performance in the areas of species identification, fin clips, descaling, and brand/tag recognition (Table 2). Up to three people (biotechnicians and/or supervisors) could participate at the same time using the same 10 fish. Overall, coworkers were in agreement with each other 99.1% of the time. Identifying fish to species was slightly better at 100%. Clips were spotted 99.3% of the time and the descaled determination was made accurately 97.6% of the time. The category of spotting elastomer tags, freeze brands, and PIT tag scars was the most improved area up from 71.5% in 1997 to 100% agreement in 1998. It should be noted that five of the six participants in these tests had one or more years of experience. For a full explanation of the test protocol, see the Methods section.

Table 2. Results of the quality control tests.

Category	ID	Clip	Descaled	Mark	Total
Errors	0	2	18	0	20
Possible	750	750	750	42	2,292
% Correct	100	99.7	97.6	100	**99.1**

Equipment

Lost or biased sample time totaled 38 hours, which represented 0.8% of the 1998 sampling season. Lost sample time was due to 3-way rotational gate malfunction, scheduled and unscheduled inspections, and/or repairs to the sampling system. Even though 1998 was a low debris year, and did not severely test the screen cleaning system, the low percentage of lost or biased time is an indication that the new SMF is a very functional system. See Table A-4 for details on biased sample days.

Table 3. Interruption of sampling summary for John Day Dam, 1998.

End Date	Batch #	Reason for interruption	Hours missed
10-Apr	98002	3-way gate malfunction	12:25
11-Apr	98003	3-way gate malfunction	?
12-Apr	98004	3-way gate malfunction	?
21-Apr	98013	Scheduled dewatering	4:00
2-July	98085	Maintenance, debris removal, repairs	1:30
7-July	98090	3-way gate malfunction	1:00
8-July	98091	3-way gate repairs	4:00
12-July	98095	General power outage at dam	0:10
15-July	98098	3-way gate malfunction	0:40
17-July	98100	3-way gate repairs	1:00
28-July	98111	Scheduled inspections and repairs	7:00
13-Aug	98127	ISO and 400kHz PIT tag efficiency tests	2:00
24-Sept	98169	Scheduled dewatering	4:15
		Minimum total sample hours missed =	38 hours

Fry Incidence

The number of summer/fall chinook fry (≤ 60mm) collected this season was 4,229. This is about 1.8 times the 2,342 collected in 1997 and about 19 times the 217 collected in 1996. In 1998, 65% of the fry were collected in April, 14% were collected in May, and 21% in June.

Adult Catch

Although the facility is equipped with an adult sampling system, it was not operational in 1998 and all fallbacks were returned directly to the river. An attempt to quantify the number of fallbacks at the adult exit, using a video recorder, was made in mid-September. The reviewing process proved too distorted, dark, and lengthy, consequently, videotaping was abandoned. An automatic tally clicker was installed at the Fish and Debris Separator (FDS) on 29 September in order to quantify the number of adult fish exiting the primary dewatering structure (PDS). A total of 642 adult fish were tallied between 29 September and 29 October. Approximately 51.4% of all fish

passed during the day and 48.6% at night. For a historical summary of fallbacks, see Table C-8.

Incidental Catch

American shad (*Alosa sapidissima*) were by far the most common incidental species captured at John Day this season. Collection numbers of juvenile American shad in 1998 (1,281,697) were 12 times the 1997 total (108,961) (Figure C-7). Juvenile shad passage started on 21 July and collection numbers peaked on 16 August at 110,400 fish. Passage averaged approximately 12,000 juvenile shad per day throughout the end of the sampling season (Figure A-4).

The estimated collection number for juvenile Pacific Lamprey (*Lampetra tridentata)* during 1998 was 149,483 (80% silvers and 20% ammocetes). This is 307 times the collection number of 486 in 1997. There were several lamprey passage peaks with the maximum daily collection of 14,657 on 1 June. A graphical look at juvenile American shad and juvenile Pacific lamprey collection estimates for all years of sampling can be found in Figure C-7. A summary of the incidental catch by species and year is presented in Table C-9.

Research

During the season, smolt-monitoring personnel provided support to five research projects. The level of support varied by project and included; fish collection, equipment set up/modification, and handling. Fish were collected from the general sample or with the Separation by Code (SBC) function of the system.

1. Randy Absolon, of the NMFS, conducted the post-construction evaluation of the new Smolt Monitoring Facility (SMF) at John Day Dam in 1998. Approximately 4,000 Spring Creek Hatchery yearling chinook and 2,000 Dworshak Hatchery steelhead were used in the evaluation. Groups of about 200 were released at various locations and recaptured in the lab. The recovery rate for yearling chinook was 96% (N=1,403) and the recovery rate for steelhead was 70% (N=951). Fish condition was very good with descaling and mortality rates below 1%. Physiological response to passage through the SMF was evaluated by measuring blood cortisol, lactic acid, and glucose levels. A total of 190 yearling chinook and 181 steelhead were sacrificed for this research. Preliminary results indicate rises in stress indicators comparable to that seen in fish passing through other monitoring facilities.

2. Sandy Downing, NMFS, Carter Stein, PSMFC, and John Rowan, BPA, and others, participated in an ISO versus 400 kHz comparative read efficiency test. About 1,350 hatchery yearling chinook were used in the study. ISO tag reading efficiency was 99.8% upstream of the 3 way gate and 99.3% on the exit flume. These results were very comparable to the 400 kHz results of 99.8% for the coils on the exit flume.

3. Theresa Martineli, U.S. Geological Service-Biological Resources Division, (USGS-BRD) radio tagged fish for use in the Evaluation of Spill Pattern Effect on Juvenile Salmonid Behavior in John Day Tailrace study. A total of 151 yearling chinook were collected and 82 (54) were tagged. A total of 156 subyearling chinook were collected, and 100 (64%) were fitted with radio transmitters.

4. Jen Bayer, USGS-BRD conducted the Evaluation of PIT tag usage on Juvenile Pacific Lamprey. SM personnel collected about 123 juvenile lamprey. Tagging was possible but resulted in about 20% mortality on smolted lamprey and 50% mortality on non-smolted lamprey (personal comm. w/Jen Bayer, 1/14/99).

5. Jim Congleton, The University of Idaho, collected fish using the separation by code (SBC) capabilities of the system to study cumulative stress from passing multiple bypass systems. From 11 May to 21 May, 560 fish were diverted of which 155 (28%) were target fish.

BONNEVILLE DAM

Included in this year's report are program summary tables. See Table D-12 (PH1) and Table D-13 (PH2) for a summary of all years of sampling, including sample dates, sampling effort, sample, collection, and index numbers.

River Conditions

River Flow

Flows in 1998 were conducive to fish passage. There was enough water to move fish quickly down river but not so much as to cause uncontrolled spill and high gas levels. Spring river flow, through May, averaged 240.7 kcfs, compared to 386.5 kcfs in 1997. The peak flow for this period was 419.9 kcfs on 31 May. Last year the high flow for this same period was 515.0 kcfs on 21 May. For June and July, river flow averaged 255.1 kcfs, considerably lower than the 378.7 kcfs for the same period last year. The highest flows for the season occurred during seven consecutive days from 28 May through 3 June. The range was 405.7 kcfs to 419.9 kcfs, more than 100 kcfs lower than the peak of 556.7 kcfs on 16 June last year. Flows for the late summer/fall period, August through October, were also lower than in 1997, averaging 125.6 kcfs versus 175.5 kcfs last year.

Spill during the 15 day period following the 13 March release of 7.7 million tule fall chinook from Spring Creek National Fish Hatchery (SCNFH) averaged about 54.5 kcfs (26% of river flow) for the period 14 March through 28 March (Table 4). Spill averaged 87.1 kcfs (45% of river flow) between 20 and 29 April to facilitate passage of the 4.2 million tule fall chinook released from SCNFH on 20 April. For the third SCNFH release of 3.7 million fish on 15 May, spill averaged 116.3 kcfs or 36% of river flow for the 10 days following the release (Table 3).

Table 4. 1998 Spring Creek National Fish Hatchery releases.

Release Date	Number (millions)	Peak PH1 Passage	Avg. River Flow	Spill as % of River
March 13	7.7	15 March	54.5	26
April 18	3.9	22 April	87.1	45
May 15	3.5	16 May	116.3	36

Shifting of flow from PH2 to spill following a Spring Creek release is thought to increase the number of those fish passing the project via the spillway and improve survival.

The Numbers

Sample Numbers

The total number of fish sampled in the first powerhouse at Bonneville Dam in 1998 was 51,565, a 32% reduction from last year's 75,797. Subyearling chinook, wild and hatchery steelhead, and coho had reductions in sample numbers, ranging from 30 to 65%. Yearling chinook and sockeye sample numbers were up, with the greatest increase (349%) seen in wild sockeye. Species specific sample numbers expressed as a percent of 1997 sample numbers are as follows: wild sockeye, 349%; hatchery sockeye, 150%; yearling chinook, 115%; wild steelhead, 70%; subyearling chinook, 70%; coho, 49%; hatchery steelhead, 35%. Subyearling chinook constituted 59% of the sample numbers, followed by yearling chinook (13.3%), coho (12%), hatchery steelhead (6.4%), wild steelhead (5%), and sockeye (3.4%) (Table 1).

Collection Estimates

Collection estimates represent the number of fish passing through the bypass system at the first powerhouse and are calculated by dividing the sample number by the sample rate. In 1998, an estimate of 794,789 is 117% of the 1997 estimate of 677,258 fish. Hatchery steelhead and coho estimates were down but all other species saw an increase in collection numbers. There are numerous components that affect collection estimates, but the primary factor is flow distribution. If more water is spilled, or run through the second powerhouse, fewer fish go through the first powerhouse. Other factors include Fish Guidance Efficiency (FGE), wild and hatchery production, transportation, research activities, and others.

Fish Passage Indices

Collection numbers are divided by the proportion of river flow through powerhouse 1 to get a Fish Passage Index (FPI) for the entire project. Since sampling is done hourly at Bonneville, an hourly index is calculated, but the daily index number will be the one referenced here. See the Methods section for definitions. The Index represents the total number of fish passing the project. It is affected by the same factors as the collection estimates, discussed above, and others. It is most useful for in-season monitoring of run timing and size. The 1998 index total for all species combined was 2,963,511, about 90% of the 1997 FPI of 3,307,458. Lower indices for coho, and steelhead offset higher indices for chinook and sockeye, resulting in the overall lower index number. A breakdown by species for sample, collection, and index numbers can be found in Table 1.

For a complete listing of sample, collection, and index numbers by species for all years of sampling, including season dates and sampling effort, see Table D-12.

Second powerhouse sampling does not generate collection or index estimates. The effort is simply to monitor fish condition as an indicator of the condition of the bypass system. A total of 12,066 smolts were sampled for this purpose. Results will be discussed in the Fish Condition section. Species composition was very similar to that seen in the first powerhouse with one exception. Yearling chinook made up 27.8% of the samples in PH2 but only 13.3% in PH1. Other species compared as follows, with PH2 listed first: subyearling chinook, 44%/59%; coho, 11%/12%; hatchery steelhead, 6%/6.4%; wild steelhead, 5.8%/5%; and sockeye, 5.9%/3.4%. For a summary of 1998 data, see Table 1. To review the history of condition monitoring in the second powerhouse, see Table D-13.

Passage Patterns

Seasonal

The run timing and duration at Bonneville this year was very similar to the historical median for all species. The greatest variance, 6 days shorter, was for yearling chinook (Figure 9). For the exact dates, refer to Table D-2. Yearling chinook passage was concentrated between 20 April and 18 May. Passage fluctuated between 2% and 5%, but there were no distinct peaks. The daily percent of total did not exceed 5%. Wild steelhead had one distinct passage peak on 6 May, of about 7% of total, and another smaller peak of about 4% on 1 June, but the rest of the season passage was well dispersed, staying below 4% of total per day. Hatchery steelhead passage peaked on 15 May at about 6% of total and like wild steelhead, had another passage peak right around 1 June. Coho and wild chinook fry also had an increase in passage around the first of June, a probable result of the season high flows occurring at this time. The spring passage pattern (before June 1) for subyearling chinook mainly represents large releases of tule stock into the Bonneville pool from Spring Creek National Fish Hatchery (Table 4). No passage dates are calculated for these fish. The summer passage pattern for subyearlings (after June 1) is composed mainly of upriver bright stock. These fish passed Bonneville in greatest numbers on 3 June (Figure 10). Passage timelines for all years and species are shown in Figure D-2. The historical average passage pattern for each species is shown in Figure D-1 and includes a line representing standard deviation on each day.

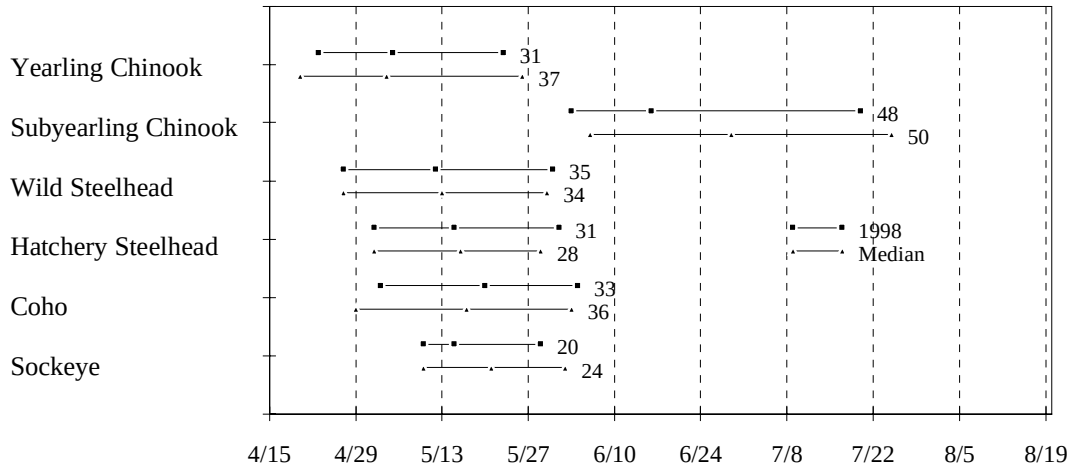

Figure 9. 10%, 50%, and 90% passage dates and the historical median at Bonneville Dam, PH1, 1998. The duration in days between the 10% and 90% passage dates is indicated for each line.

Diel

In 1998, sampling in the first powerhouse at Bonneville Dam remained at 8 hours per day, from 1600 to 2400 hours. Passage for all species increased at dusk, about 2000 hours and peaked at 2200 hours (Figure 11). This is consistent with the passage pattern established during the 4 years of 24 hour monitoring (92-95) (Figure D-3, Figure D-4). For a total percent night passage by species for each year of 24 hour monitoring, see Table D-1.

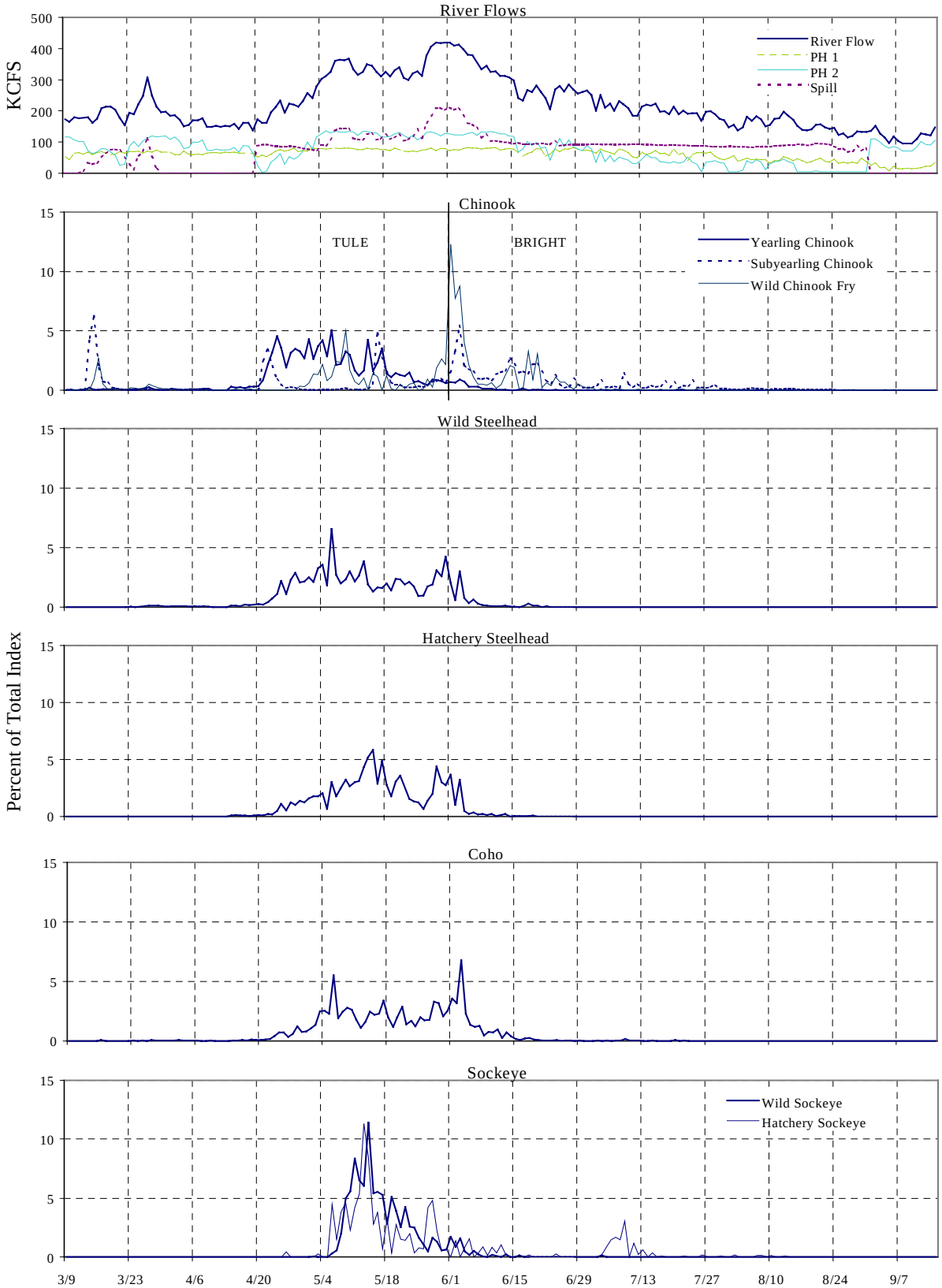

Figure 10. Seasonal passage patterns and daily average flows at Bonneville Dam, 1998.

The 8-hour passage patterns of tule and bright stocks of subyearling chinook follow the same general pattern as spring migrants (increasing at dusk, peaking at 2200 hours) but are slightly different. Increases in Tule passage began earlier, at about 1800 hours, had a smaller peak at 2200 hours, then averaged a lower percent of total passage for the remaining hours. Upriver bright passage resembled the spring migrants, with a larger, more abrupt increase at 2200 hours and a gradual decline in passage thereafter (Figure 12).

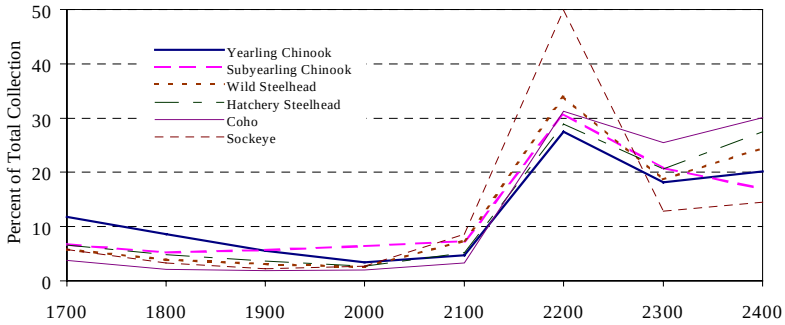

Figure 11. Eight hour passage patterns from PH1 at Bonneville Dam, 1998.

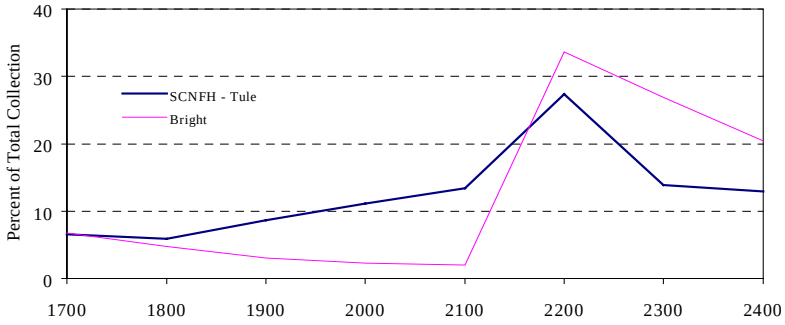

Figure 12. Eight hour passage patterns of subyearling chinook stocks from PH1 at Bonneville Dam, 1998.

Fish Condition

Powerhouse 1

In general, descaling was about the same as the 1997 and historical levels (Figure 13, Table D-10, and Figure D-5). Sockeye changed the most, going from 14.3% last year to 17.3% this year, which is still lower than the historical average of 20.9% (Table D-3). All other species were within 1.2% of last year's levels (Figure 13).

Daily descaling was highly variable for all species, but in general increased as the migration progressed. The exception is wild steelhead, which had lower descaling during the last half of May than the first half (Figure B-5). Overall mortality rates were less than 0.5% for all species (Figure 14 and Table D-4). This low level of recorded mortality is consistent with previous years (Figure D-6)

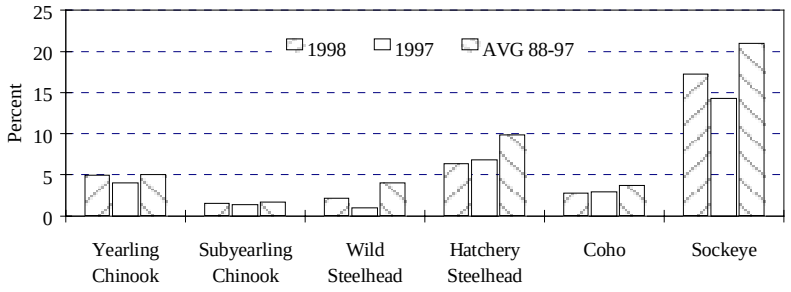

Figure 13. Total descaling for 1998, compared to 1997 and the 88-97 average at Bonneville Dam, PH1.

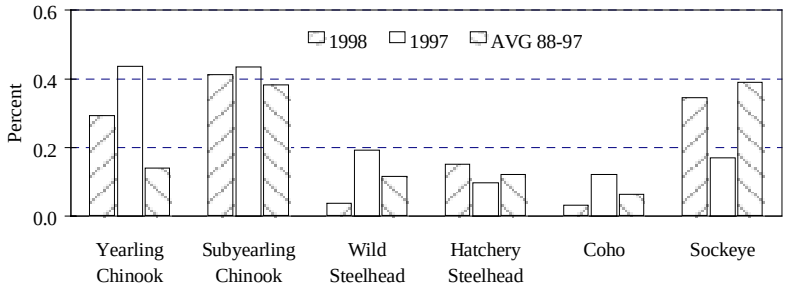

Figure 14. Total mortality for 1998, compared to 1997 and the 88-97 average at Bonneville Dam, PH1.

Powerhouse 2

Coho descaling was higher this year than last year and the historical average. Wild steelhead descaling was slightly higher than last year but lower than the historical average. All other species had descaling levels lower than the previous year and the historical average (Figure 15, Table D-5, and Figure D-5)

Normally, fish sampled in PH2 have a higher rate of descaling than fish sampled in PH1. However, this year, four of the six species sampled had a lower rate of descaling in PH2 than in PH1. Only coho and subyearling chinook had higher descaling in PH2 (Tables D-4-5). This is surprising considering that fish collection for research dramatically increased the number of fish held and handled in PH2. Conventional wisdom would suggest that holding large numbers of fish in the raceways prior to processing would produce higher descaling rates.

The biggest difference in descaling rates was for sockeye, with 17.3% at PH1 and 11.3% in PH2.

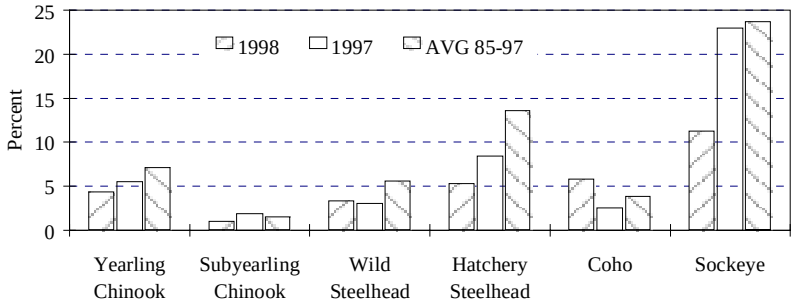

Figure 15. Total descaling for 1998, compared to 1997 and the 88-97 average at Bonneville Dam, PH2.

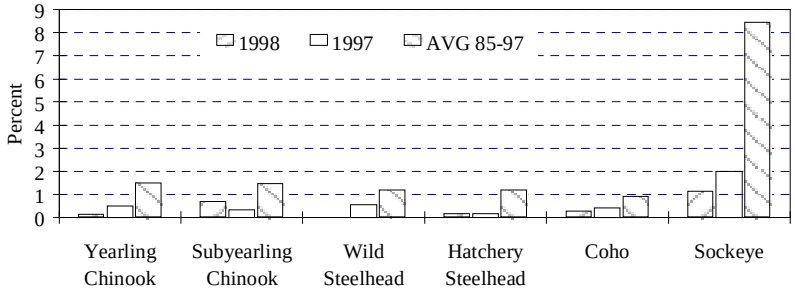

Figure 16. Total mortality for 1998, compared to 1997 and the 88-97 average at Bonneville Dam, PH2.

Overall, mortality rates were slightly higher in PH2, but very low in both powerhouses. The highest mortality rate in samples from PH2 this year was for coho at 0.7 (Table 1 and Figure 16). For a summary of all years' descaling and mortality rates in PH2, see Table D-5.

Subsampled Fish Condition

A total of 9,345 smolts from PH1 samples were examined for detailed condition subsampling in 1998. As in previous years, partial descaling (3-19%) was the most prevalent condition ranging from 26.6% for sockeye to 7.6% for coho. Partial descaling percentages by species were virtually unchanged from 1997. Attempted bird predation on hatchery steelhead was up slightly from 6.8% last year to 7.5% this year. About 2% of the wild steelhead showed signs of attempted bird predation, unchanged from last year. After several years of decline, 19.3% in 1995, 8.1% in 1996, and 4.6% in 1997, the incidence of external parasites on wild steelhead appears to have leveled out with an incidence of 4.6% again this year. For a summary of all years of condition subsampling see Table D-6.

Gas Bubble Trauma Examinations

A total of 7,259 fish were examined for symptoms of gas bubble trauma in 1998 (Table B-6). Of those, 69, or 1.0%, showed symptoms with the majority of bubbles found in the unpaired fins (55%). Almost 98% of symptoms on the unpaired fins were of rank of 1 or 2. So, for discussion purposes, all of the observations, regardless of rank or location, were lumped together. Steelhead had the highest incidence of bubbles at 2.0% (37 of 1,863) with 95% of those found in May and June. Of the 1,904 yearling chinook examined, 31 (1.6%) had signs that were observed in April and May, 48.4% and 51.6%, respectively. The average monthly spill for Bonneville Dam was greatest in May and 54.5% of all GBT symptoms were observed in that month. In contrast, only one subyearling chinook (0.3%) out of 3,492 examined from June through August was observed with gas bubble symptoms.

Length Averages

Individual fish lengths were obtained in conjunction with the fish condition subsampling described above. The results are intended to show relative length trends throughout the season and are presented in Figure 17. Hatchery steelhead, as in past years, remained the largest juvenile salmonid sampled throughout the season. Both hatchery steelhead and subyearling chinook showed increasing size trends as the season progressed, while wild steelhead, yearling chinook, coho and sockeye size varied over the course of the migration.

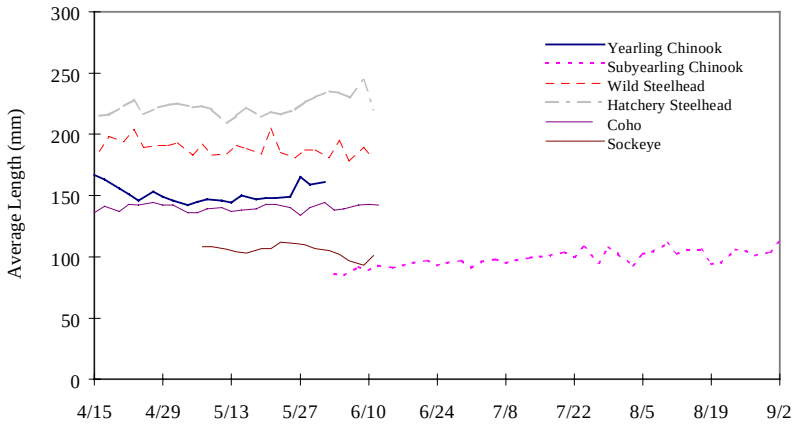

Figure 17. Average length of juvenile salmonids at Bonneville Dam, PH1, 1998.

PIT tags and External Marks

PIT Tags

A total of 43,131 PIT tags were detected at Bonneville this year (Table B-2 or D-7) which is an increase of almost 17,400 over 1997 (25,507). The increase is due to a continuing Corps of Engineers funded research project, conducted by the National Marine Fisheries Service, to evaluate survival through The Dalles Dam spillway. The PIT tag tunnel/diverter system equipped with a recapture station was used again this year. This device diverts PIT tagged fish in the sample to a separate holding tank so condition data can be collected. Estimates of diversion efficiency by species are listed in Table B-1. For the condition data, please see the PTAGIS database administered by the Pacific States Marine Fisheries Commission. Table D-7 summarizes PIT tag records by year for all years of interrogation at Bonneville Dam, PH1.

Freeze Brands

At PH1, seven freeze brands were recorded this year, down from 30 last year. All of the brands were found on hatchery steelhead released from one of three sites, Lyons Ferry Hatchery, Dayton Acclimation Ponds, and Cottonwood Acclimation Ponds (Table B-3). Table D-8 lists the number of brands for each species for all years of monitoring. At PH2, one brand was recorded this year, down from two last year.

Elastomer Tags

At PH1, 219 elastomer tags were recorded this year, down from 352 in 1997. Nearly all of the tagged summer steelhead (156 of 161) originated in the Wenatchee and Entiat Rivers. Most of the tagged yearling chinook (45 of 59) can be traced to Lyons Ferry Hatchery (Table B-3). At PH2, 42 elastomer tags were recorded down from 59 last year (Table B-4). Almost all of those (36 of 42) recoveries were in yearling chinook from Lyons Ferry Hatchery.

Fry Incidence

This year, 510 chinook fry and 28 coho fry (fork length $\leq$60mm) were sampled. The number of chinook fry is up slightly from last year when 459 were sampled, but coho numbers are more than double last year's total of 13. When expanded by sample rate, these numbers generate a collection estimate of 8,116 chinook fry and 452 coho fry, up considerably from last year when 3,761 chinook fry and 105 coho fry were collected. Fry counts for both species are still down considerably from the numbers recorded during the four years of 24 hour monitoring, 1992 – 1995. The lower fry collection counts during 1996, 1997, and 1998 can be partially explained by the reduced sample effort, from 24 to 8 hours. See Table D-11 for a summary of sample and collection numbers for fry by species per year.

Adult Catch

The sample collection equipment at both powerhouses is designed to pass adult fish. As a result, very few adults are collected in our samples. This year, no adults were captured in either powerhouse, down from 1997 when two

adults and five mini jacks were found in PH1 and PH2 samples respectively (Table D-9).

Incidental Catch

American Shad (*Alosa sapidissima*) juveniles were present in the samples from mid August through the end of the season and passage peaked on 30 October (Figure B-6). The collection count was 820,864, almost double the 1997 total. **Pacific Lamprey** (*Lampetra tridentata*) juveniles were most abundant during the last half of May and passage peaked on 1 June (Figure B-6). The total number of lamprey sampled was 44, all but one were smolted. Sample numbers expanded by sample rate generated a collection estimate of 464, less than half of last year's total. A summary of incidental catch for the years 1989 - 1998 is presented in Table D-10. A graphical comparison of juvenile shad and lamprey abundance by year is presented in Figure D-7.

Performance Monitoring

Personnel

Numerous tests were conducted this year to evaluate employee performance in the areas of species identification, presence of fin clips, descaling assessment, and mark and tag recognition. The way the tests were conducted this year (see Methods section) does not lend itself to absolute right or wrong results but rather how often the people doing the tests recorded the same information for the same fish. The "Mark" category generated the lowest efficiency rating at 88.9%. Overall, coworkers were in agreement 99.8% of the time (Table 5).

Table 5. Results of quality control tests.

Category	ID	Clip	Descaled	Mark	Total
Errors	1	0	3	1	5
Possible	1030	1030	1030	9	3099
% Correct	99.9	100	99.7	88.9	**99.8**

Equipment

At PH1, a total of 56 hours of sampling were missed, about 3.0% of the season. See Table B-5 for more details on lost sample time.

At PH2, no samples were lost or biased due to equipment problems. Sampling in PH2 was suspended during the large releases of Tule fall chinook from the Spring Creek National Fish Hatchery (SCNFH).

Research

During the season, NMFS smolt monitoring personnel collected and held fish for four research projects. In the first powerhouse, fish were collected from the general sample. In the second powerhouse, the number of fish diverted was estimated using 5-minute counts every 30 minutes and extrapolating. The fish were diverted to holding raceways in the FERL until the target number was reached, after which all fish were diverted back to the river. Fish were sorted and PIT tagged by the research crew the following day. The four studies are listed below.

1. NMFS researchers conducted The Dalles Dam Spillway Survival Study, which was designed to determine survivability of juvenile salmonids through The Dalles Spillway. Fish were collected from powerhouse 2 and PIT tagged from 20 April through 23 July. Over 64,000 coho and 80,000 subyearling chinook were PIT tagged during that time period.
2. United States Geological Survey conducted a Radio Telemetry study designed to determine movement, distribution, and passage behavior of radio-tagged salmonids at Bonneville Dam. From 22 June through 17 July, 345 yearling chinook, 368 steelhead, and 550 subyearling chinook were collected and radio-tagged.
3. Oregon Cooperative Fishery Research Unit conducted a project to evaluate migration routes and survival of juveniles following transportation. As part of their research, 148 yearling chinook were radio-tagged and 42 were sacrificed for physiological studies.
4. The University of Idaho recovered and sacrificed 16 PIT tagged yearling chinook in research to assess physiological responses to passage through multiple dams at fish handling facilities.

ACKNOWLEDGMENTS

Support for this monitoring project comes from the region's electrical ratepayers through the Bonneville Power Administration under the Northwest Power Planning Council's Fish and Wildlife Program. The success of this program continues to involve cooperative interaction with the Fish Passage Center staff and the Environmental and Technical Services Division of the National Marine Fisheries Service.

We acknowledge the very capable efforts of our Biological technicians and laborers, including at Bonneville: Daryl Banaszek John Barton, Larry Dick, Terry Hurd, Mildred Johnson, Robert B. Mills, Carol Morat, Mark Peterson, Jerry Rogers, Tom Ryan, and Mathew Wilcox; and at John Day: John Howell, Tammy Mackey, William Myers, Paula White, and Erin Wright.

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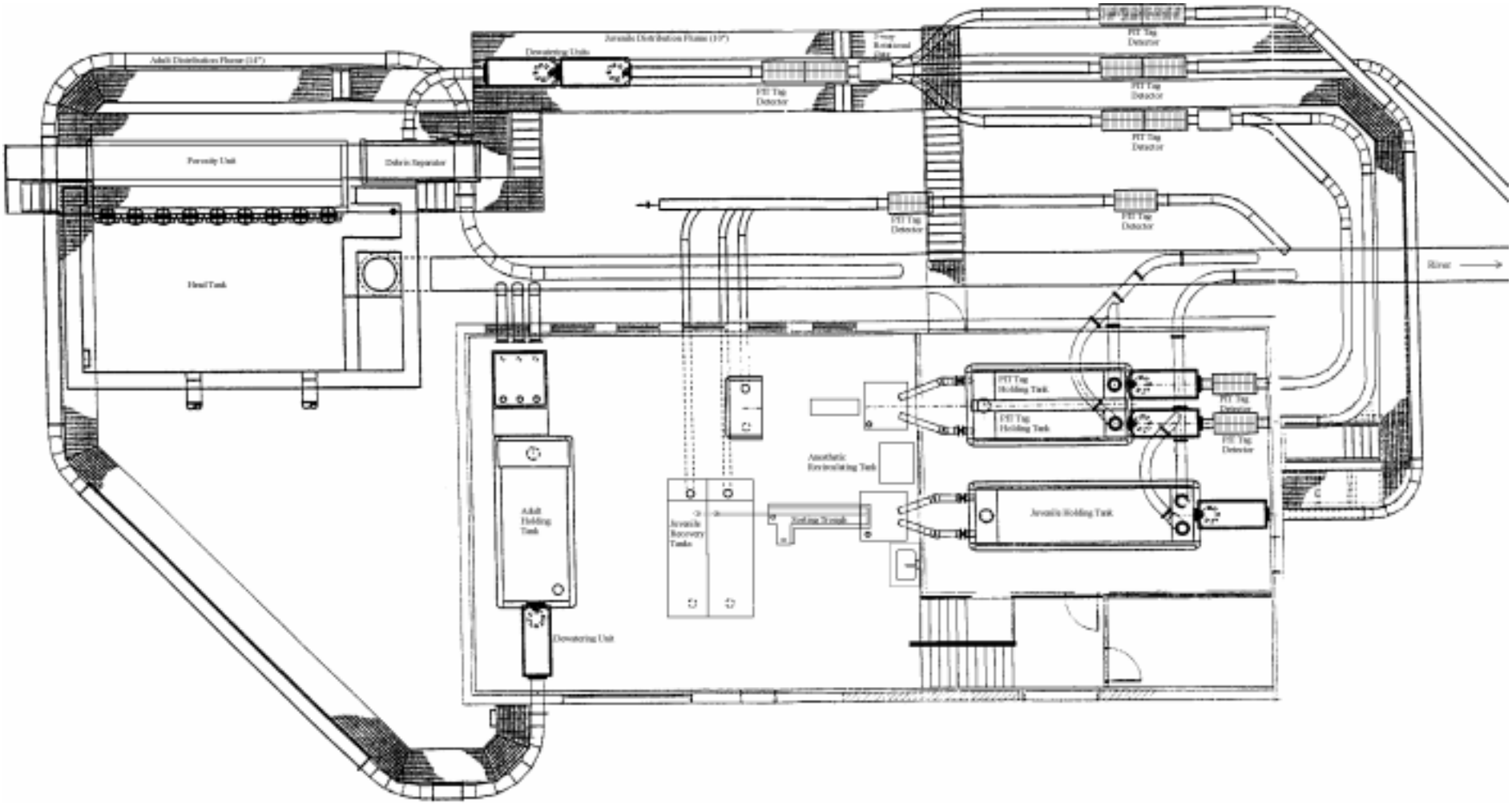

Figure A-1. Smolt Monitoring Facility at John Day Dam, 1998.

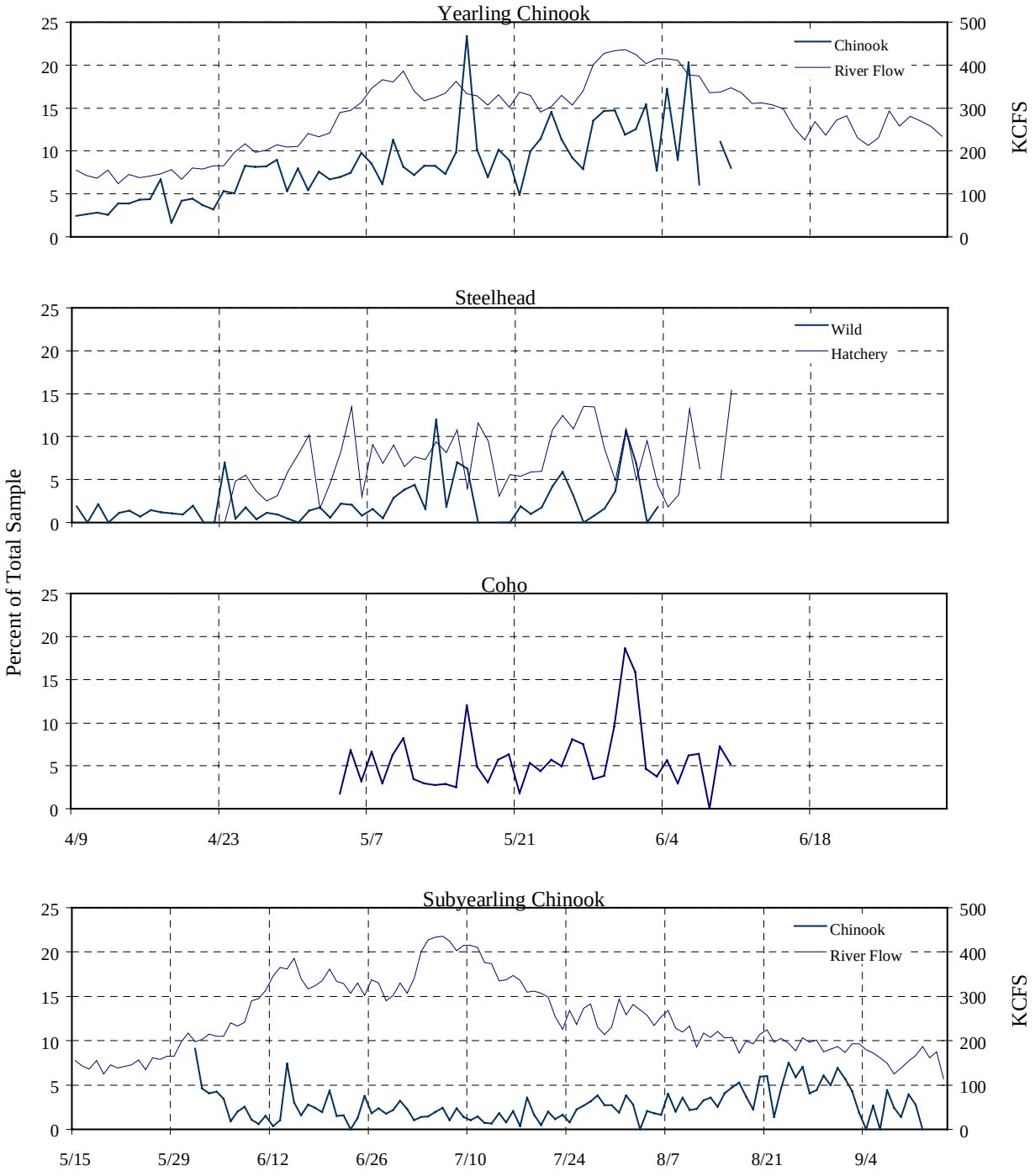

Figure A-2. Daily percent descaling and river flow at John Day Dam, 1998. Days with sample size of less than 30 have been excluded.

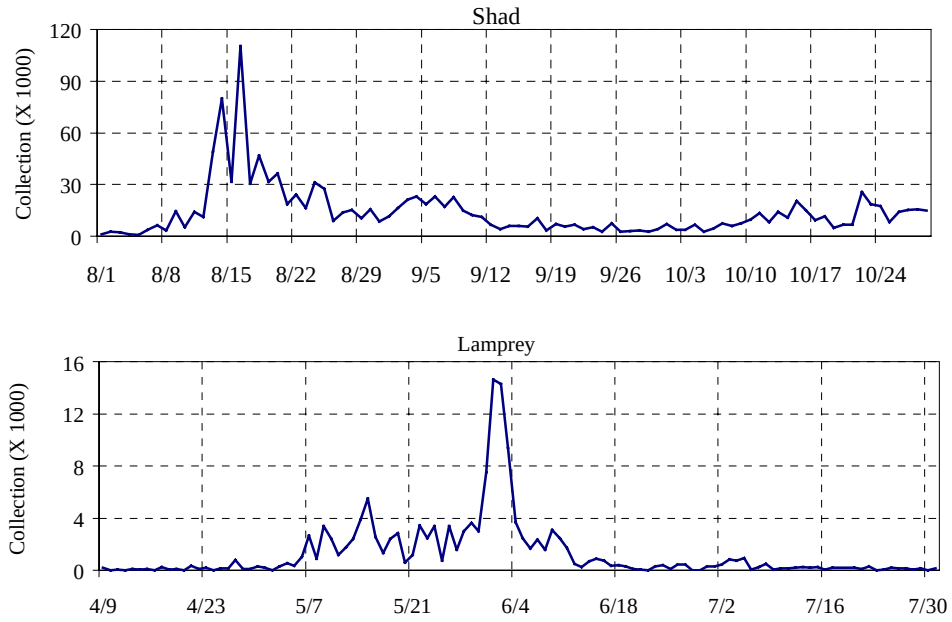

Figure A-3. Seasonal juvenile shad and lamprey collection at John Day Dam, 1998.

Table A-1. Summary of PIT tag detections at John Day Dam, 1998.

Migration Year	Species	Run	Rear	Observations	Species Totals	Migration Year Totals
Unknown	Chinook	Spring	Wild	4	4 Chinook	**4**
1996	Steelhead	Summer	Unknown	3		
	Steelhead	Summer	Wild	30	33 Steelhead	**33**
1997	Chinook	Spring	Wild	1		
	Chinook	Fall	Hatchery	255		
	Chinook	Unknown	Unknown	1		
	Chinook	Unknown	Wild	2	259 Chinook	
	Steelhead	Summer	Hatchery	14		
	Steelhead	Summer	Wild	387	401 Steelhead	**660**
1998	Chinook	Unknown	Hatchery	366		
	Chinook	Spring	Hatchery	8,528		
	Chinook	Spring	Wild	1,237		
	Chinook	Summer	Hatchery	3,656		
	Chinook	Summer	Unknown	1		
	Chinook	Summer	Wild	832		
	Chinook	Fall	Hatchery	11,919		
	Chinook	Fall	Unknown	3		
	Chinook	Fall	Wild	282		
	Chinook	Unknown	Hatchery	5,598		
	Chinook	Unknown	Unknown	3,339		
	Chinook	Unknown	Wild	1,188	36,949 Chinook	
	Coho	Fall	Hatchery	652		
	Coho	Fall	Unknown	484	1,136 Coho	
	Steelhead	Summer	Hatchery	8,095		
	Steelhead	Summer	Unknown	7		
	Steelhead	Summer	Wild	2,093		
	Steelhead	Unknown	Hatchery	63	10,258 Steelhead	
	Sockeye	Summer	Hatchery	186		
	Sockeye	Summer	Wild	16		
	Sockeye	Unknown	Hatchery	13		
	Sockeye	Unknown	Unknown	4		
	Sockeye	Unknown	Wild	355	574 Sockeye	
	Unknown	Unknown	Wild	1	1 Unknown	**48,918**
			Total Observations at John Day Dam:			**49,615**

Table A-2. External mark recapture data from John Day Dam, 1998.

Elastomer Tags

Species	Location	Color	Release Site	Release Number	Number Recaptured
Yearling Fall Chinook	Left	Blue	Cpt.John Acclim. Pond	133205	16
	Left	Green	Clearwater R.	81172	14
	Left	Orange	Unknown		1
	Left	Red	Lyons Ferry Hatchery	418992	381
	Right	Green	Pittsburg Landing	141814	20
Summer Steelhead	Left	Green	Wenatchee R./Entiat R./Turtle Rock	245607	192
	Left	Orange	Entiat R.	3736	48
	Left	Red	Unknown		6
	Right	Blue	Wenatchee R.	1300	2
	Right	Green	Wenatchee R.	124520	169
				Total Elastomer tags =	**849**

Freeze Brands

Species	Location*	Code	Orient.	Release Site	Release Number	Number Recaptured
Summer Steelhead	LA,RA	7U	1	Dayton Acclim. Pond	40845	28
	LA,RA	H	1,2	Lyons Ferry Hatchery	82817	41
	LA	IJ	1,2	Tucannon R.	50326	10
	RA	IJ	1,3	Cottonwood Acclim. Pond	49965	5
				Total Freeze Brands =		**84**

* LA = left anterior, RA = right anterior

Table A-3. Gas Bubble Trauma (GBT) examination summary for John Day Dam, 1998.

			Incidence of Gas Bubble Trauma symptoms						
			Percentage of sample*				**Smolt Affected**		Monthly %
Month	**Species**	**Sample Size**	occlusion in lateral line	occlusion in eyes	unpaired fins ranks 1 and 2	unpaired fins ranks 3 and 4	Number	Percent	of Season Totals
April	Spring Chinook	900	0.3%	0.0%	0.0%	0.0%	3	0.3%	2.9%
	Wild Steelhead	624	0.0%	0.0%	0.0%	0.0%	0	0.0%	0.0%
	Hatchery Steelhead	89	0.0%	0.0%	0.0%	0.0%	0	0.0%	0.0%
Monthly Total		1613	0.2%	0.0%	0.0%	0.0%	3	0.2%	2.9%
May	Spring Chinook	1300	0.1%	0.4%	1.0%	0.0%	19	1.5%	18.6%
	Wild Steelhead	649	0.0%	0.0%	0.6%	0.0%	4	0.6%	3.9%
	Hatchery Steelhead	751	0.3%	0.0%	3.2%	0.1%	25	3.3%	24.5%
Monthly Total		2700	0.2%	0.3%	2.5%	0.1%	48	1.8%	47.1%
June	Spring Chinook	400	0.0%	0.3%	4.0%	0.5%	18	4.5%	17.6%
	Fall Chinook	900	0.0%	0.3%	0.6%	0.0%	6	0.7%	5.9%
	Wild Steelhead	140	0.0%	0.0%	0.7%	0.0%	1	0.7%	1.0%
	Hatchery Steelhead	240	0.0%	0.0%	6.7%	0.0%	15	6.3%	14.7%
Monthly Total		1680	0.0%	0.1%	2.3%	0.1%	40	2.4%	39.2%
July	Fall Chinook	1300							
Monthly Total		1300	0.0%	0.0%	0.2%	0.0%	4	0.3%	3.9%
August	Fall Chinook	1274							
Monthly Total		1274	0.0%	0.0%	0.5%	0.0%	7	0.5%	6.9%
Season Totals	Spring Chinook	2600	0.2%	0.2%	1.1%	0.1%	40	1.5%	
	Fall Chinook	3474	0.0%	0.1%	0.4%	0.0%	17	0.5%	
	Wild Steelhead	1413	0.0%	0.0%	0.4%	0.0%	5	0.4%	
	Hatchery Steelhead	1080	0.2%	0.0%	3.7%	0.1%	40	3.7%	
Season Total		8567	0.1%	0.1%	1.0%	0.0%	**102**	**1.2%**	
Total number of symptoms in each location			6	8	89	3	106		
% of symptoms in each location			5.7%	7.5%	84.0%	2.8%			

NOTE: GBT symptoms were ranked as follows: 0 = 0% coverage, 1 = 1-5% coverage, 2 = 6-25% coverage, 3 = 26-50% coverage, and 4 = greater than 50% coverage.

* some smolt exhibited multiple symptoms

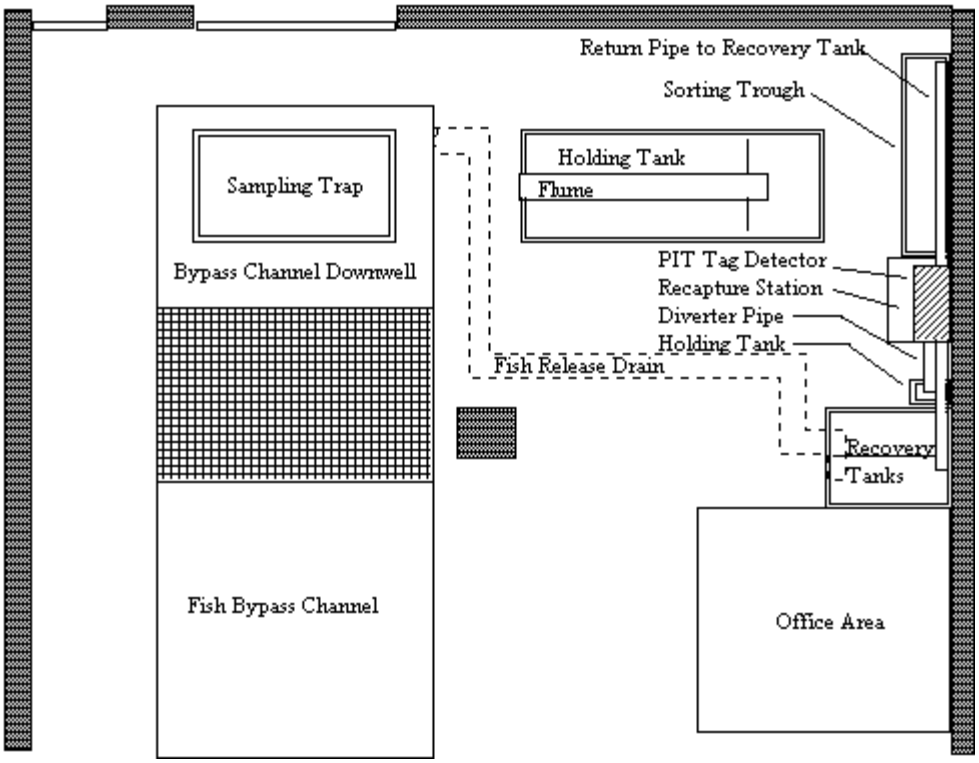

Figure B-1. Smolt monitoring system at Bonneville Dam, PH1, 1998.

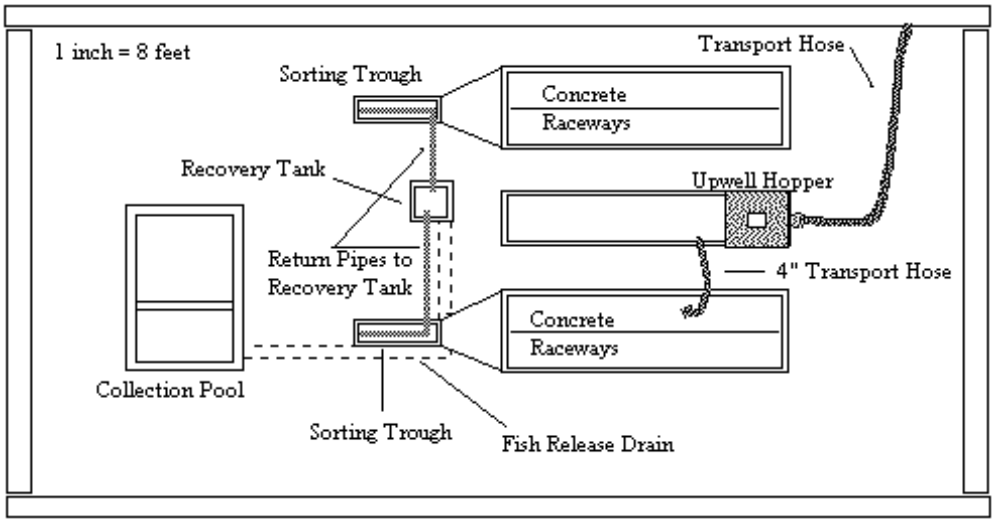

Figure B-2. Smolt monitoring system at Bonneville Dam, PH2, 1998.

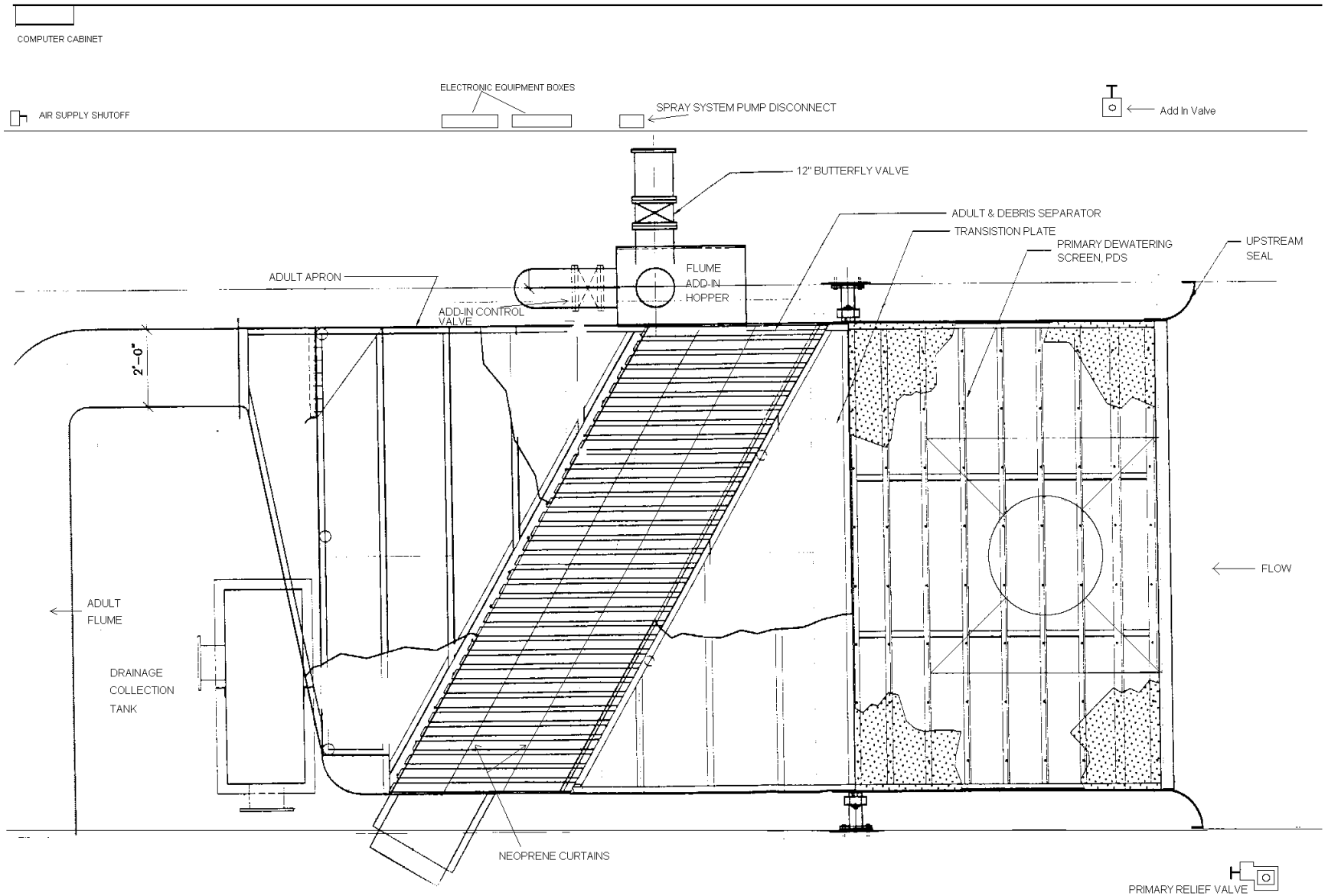

Figure B-3. Top view of PIT tag system, PH2, Bonneville Dam, 1998.

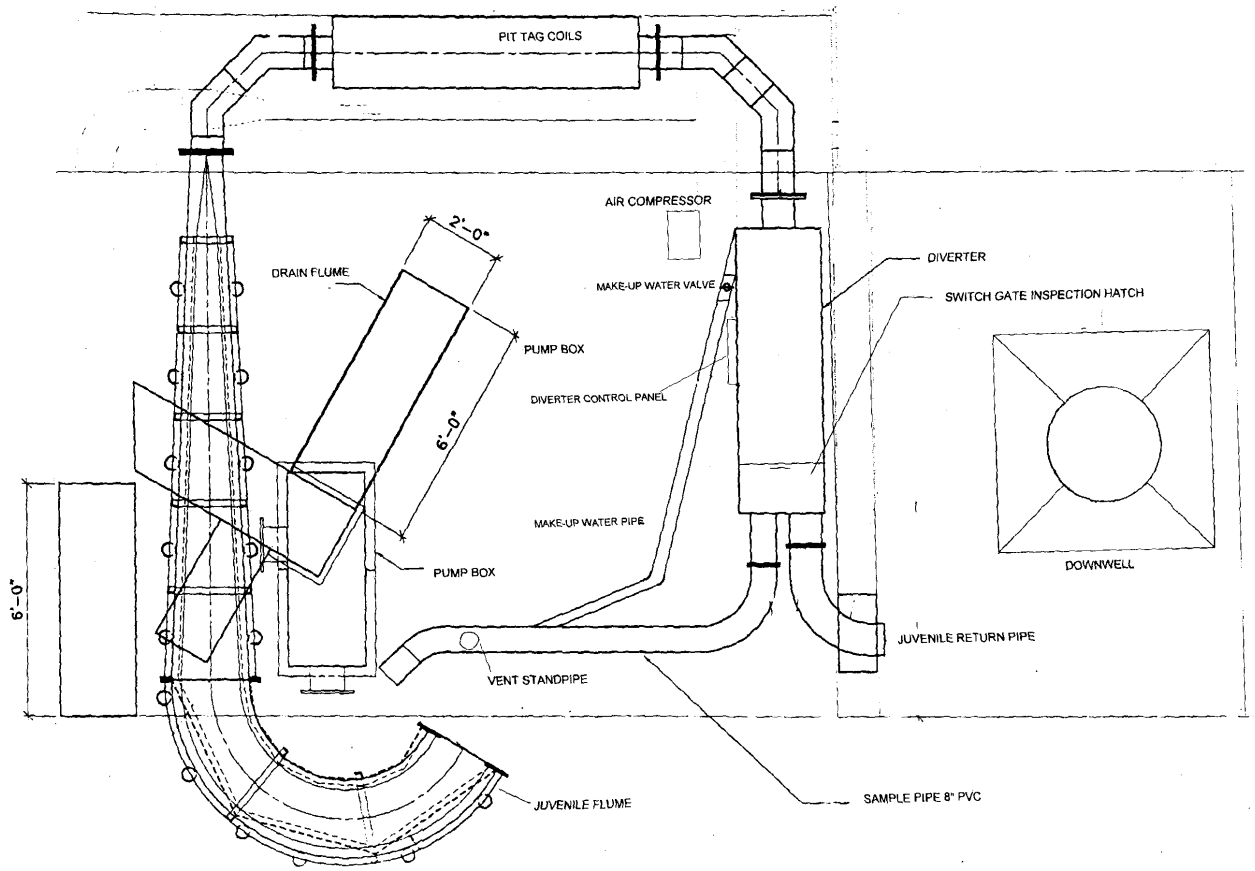

Figure B-4. Lower level or "Sump" area of PIT tag system, PH2, Bonneville Dam, 1998.

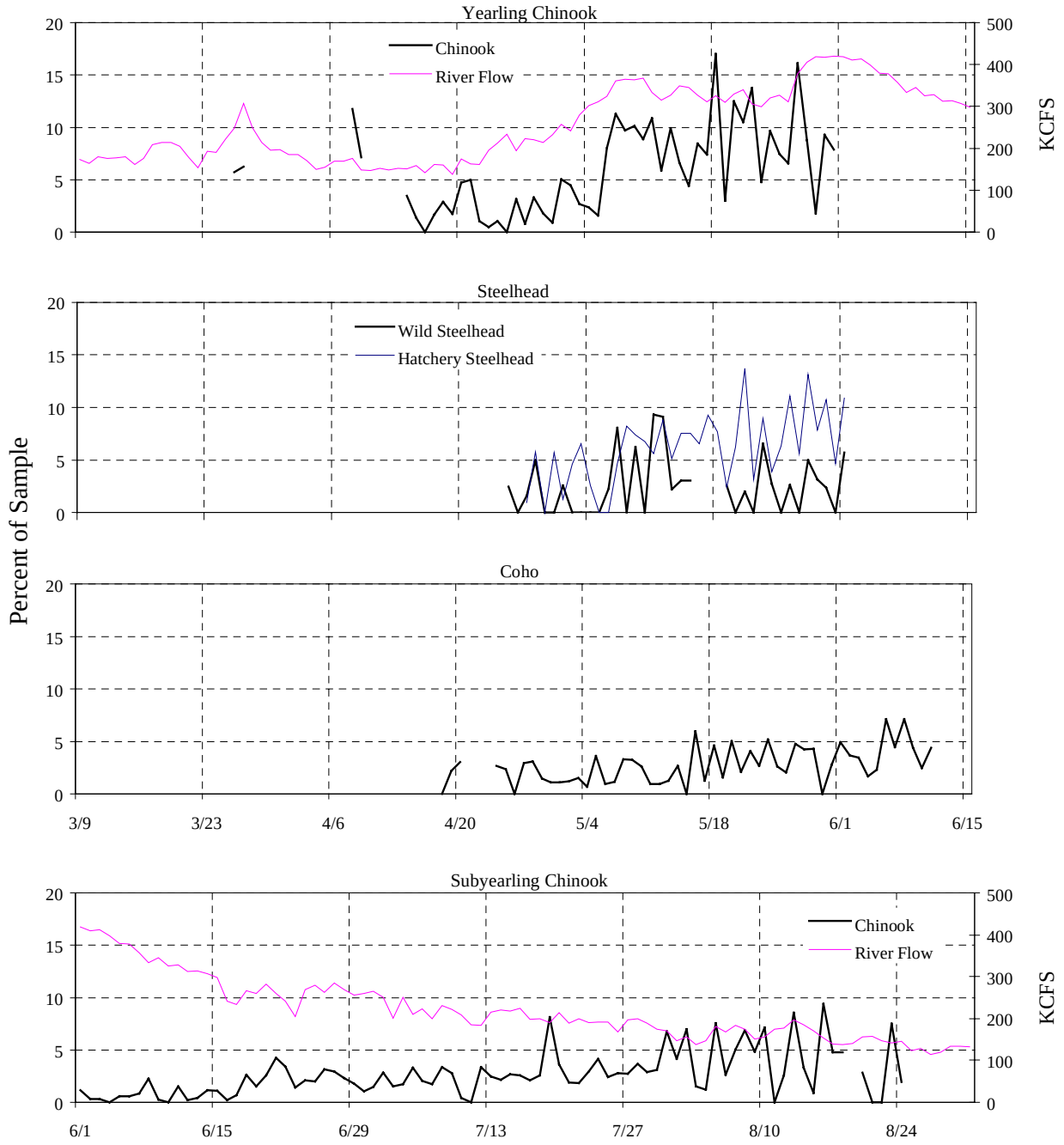

Figure B-5. Daily percent descaling and river flow at Bonneville Dam, PH1, 1998. Days with sample size of less than 30 have been excluded.

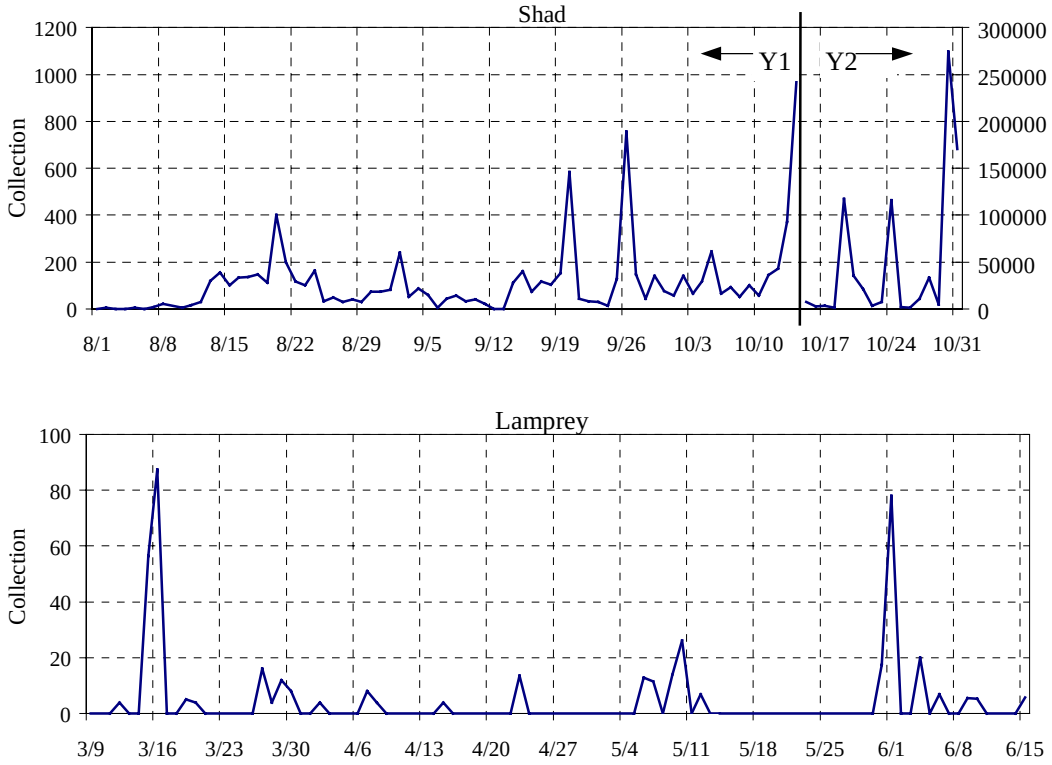

Figure B-6. Seasonal juvenile shad and lamprey collection at Bonneville Dam, 1998.

Table B-1. Summary of PIT tag recapture data at Bonneville Dam, PH1, 1998.

Species	Run	Rearing Type	Diverter Coil	Recapture Station	Recapture Efficiency (%)
Chinook	Spring	Hatchery	27	20	74.1
		Wild	3	2	66.7
	Summer	Hatchery	6	3	50.0
		Wild	4	1	25.0
	Fall	Hatchery	31	23	74.2
		Wild	5	3	60.0
	Unknown	Hatchery	21	17	81.0
		Wild	6	4	66.7
		Unknown	8	3	37.5
Chinook Total	111	76	68.5		
Coho	Fall	Hatchery	1	0	0.0
	Fall	Unknown	4	1	25.0
	Unknown	Unknown	67	53	79.1
Coho Total	72	54	75.0		
Steelhead	Summer	Hatchery	24	23	95.8
		Wild	8	8	100.0
		Unknown	1	0	0.0
Steelhead Total	33	31	93.9		
Sockeye	Unknown	Hatchery	1	1	100
		Wild	1	1	100
Sockeye Total	2	2	100		
Total, all species	218	163	74.8		

Table B-2. Summary of PIT tag detections at Bonneville Dam, 1998.

		Chinook											Steelhead			Coho					Sockeye				
		Wild				Hatchery							Wild	Hatchery	Unknown	Hatchery	Unknown				Hatchery		Unknown	Wild		
		SP	SU	FA	UN	SP	SU	FA	UN	SU	FA	UN	SU	SU	UN	SU	FA	UN	SU	FA	UN	SU	UN	UN	SU	UN	**Totals**
Unknown	B2J	1																									1
Total Unknown		**1**																									**1**
1995	B2J																										0
	BVJ																										0
	BVX								2*				1														3
Total 1995									**2**				**1**														**3**
1996	B2J												6	2													9
	BVJ														1												1
	BVX												5		1												6
Total 1996													**11**	**2**	**3**												**16**
1997	B2J		1					92					89	4													186
	BVJ							1																			1
	BVX		2		1			93					97	4	1												198
Total 1997			**3**		**1**			**186**					**186**	**8**	**1**												**385**
1998	B2J	454	312	45	570	4,277	1,541	2,693	3,079	1	2,224	1,055	634	2,293	9		157	117			4,064	117	9		8	99	23,758
	BVJ	3	4	5	6	27	6	30	20			8	8	24			1			4	67			1		1	215
	BVX	373	285	29	456	3,259	817	2,115	1,917		1,667	820	642	2,420		1	111		1	64	3,665	44	3	1	4	58	18,752
Total 1998		**830**	**601**	**79**	**1,032**	**7,563**	**2,364**	**4,838**	**5,016**	**1**	**3,891**	**1,883**	**1,284**	**4,737**	**9**	**1**	**269**	**117**	**1**	**68**	**7,796**	**161**	**12**	**2**	**12**	**158**	**42,725**
1999	BVX	1																									1
Total 1999		**1**																									**1**
Season	B2J	455	313	45	570	4,277	1,541	2,785	3,079	1	2,224	1,055	729	2,299	9	1	157	117	0	0	4,064	117	9	0	8	99	**23,954**
Total	BVJ	3	4	5	6	27	6	31	20	0	0	8	8	24	0	1	1	0	0	4	67	0	0	1	0	1	**217**
	BVX	374	287	29	457	3,259	817	2,208	1,919	0	1,667	820	745	2,424	0	3	111	0	1	64	3,665	44	3	1	4	58	**18,960**
Totals		**832**	**604**	**79**	**1,033**	**7,563**	**2,364**	**5,024**	**5,018**	**1**	**3,891**	**1,883**	**1,482**	**4,747**	**9**	**5**	**269**	**117**	**1**	**68**	**7,796**	**161**	**12**	**2**	**12**	**158**	**43,131**

* fallback adults

Sp=Spring, SU=Summer, FA=Fall, UN=unknown

BVX=Bonneville first powerhouse, B2J=Bonneville second Powerhouse, BVJ=Bonneville PIT tag recapture station at first powerhouse.

Table B-3. External mark recapture data from Bonneville Dam, PH1, 1998.

Elastomer Tags

Species	Location	Color	Release Site	Release Number	Number Recaptured
Yearling Fall Chinook	Left	Blue	Cpt. John Acclim. Pond	133205	3
	Left	Green	Clearwater R.	81172	4
	Left	Red	Lyons Ferry Hatchery	418992	45
	Right	Green	Pittsburg Landing	141814	6
Summer Steelhead	Left	Green	Wenatchee R., Entiat R.	318450	70
	Left	Orange	Wenatchee R., Entiat R.	40935	13
	Left	Yellow	Unknown		1
	Left	Red	Unknown		1
	Right	Red	Unknown		3
	Right	Green	Turtle Rock, Wenatchee R., Entiat R.	294270	73
				Total Elastomer tags =	**219**

Freeze Brands

Species	Location*	Code	Orient.	Release site	Release Number	Number Recaptured
Summer Steelhead	LA,RA	7U	1,2	Dayton Acclim. Pond	40845	3
	LA	H	1	Lyons Ferry Hatchery	82817	1
	LA	IJ	3	Cottonwood Acclim. Pond	49965	3
					Total Freeze Brands =	**7**

* LA = left anterior, RA = right anterior

Table B-4. External mark recapture data from Bonneville Dam, PH2, 1998.

Elastomer Tags

Species	Location	Color	Release Site	Release Number	Number Recaptured
Yearling Fall Chinook	Left	Green	Clearwater R.	81172	1
	Left	Red	Lyons Ferry Hatchery	418992	36
	Right	Green	Pittsburg Landing	141814	1
Summer Steelhead	Left	Green	Wenatchee R., Entiat R.	318450	2
	Right	Green	Turtle Rock, Wenatchee R., Entiat R.	294270	2
				Total Elastomer tags =	**42**

Freeze Brands

Species	Location*	Code	Orient.	Release Site	Release Number	Number Recaptured
Summer Steelhead	LA	7U	1	Dayton Acclim. Pond	40845	1
					Total Freeze Brands =	**1**

* LA = left anterior, RA = right anterior

Table B-5. Interruptions in the sampling season at Bonneville Dam, 1998.

Powerhouse 1			
Date	Batch Number	Reason for Outage	Hours Missed
11-Mar	98003	Inclined Screen Repairs	8
10-13 Apr	98033 – 98036	Trap Lift Mechanism Repairs	32
12-13 Sept	98188 - 98189	Inclined Screen Sweep Motor Repairs	16
		Total hours missed	**56**
No sampling interruptions occurred in Powerhouse 2 during 1998.			

Table B-6. Gas bubble trauma (GBT) examination summary for Bonneville Dam, 1998.

			Incidence of Gas Bubble Trauma symptoms						
			% of monthly sample*				**Smolt Affected**		Monthly %
Month	**Species**	**Sample Size**	occlusion in lateral line	occlusion in eyes	unpaired fins ranks 1 and 2	unpaired fins ranks 3 and 4	Number	Percent	of Season Totals
April	Spring Chinook	860	0.8%	0.0%	1.0%	0.0%	15	1.7%	34.1%
	Wild Steelhead	228	0.0%	0.0%	0.4%	0.0%	2	0.9%	4.5%
	Hatchery Steelhead	179	0.0%	0.0%	0.0%	0.0%	0	0.0%	0.0%
Monthly Total		1267	0.6%	0.0%	0.8%	0.0%	17	1.3%	38.6%
May	Spring Chinook	1044	0.5%	0.1%	0.4%	0.0%	10	1.0%	0.0%
	Wild Steelhead	456	0.0%	1.1%	0.7%	0.0%	8	1.8%	18.2%
	Hatchery Steelhead	817	1.0%	0.7%	0.2%	0.0%	16	2.0%	36.4%
Monthly Total		2317	1.0%	0.9%	0.7%	0.0%	34	1.5%	54.5%
June	Fall Chinook	1300	0.0%	0.0%	0.0%	0.0%	0	0.0%	0.0%
	Wild Steelhead	73	0.0%	0.0%	13.7%	0.0%	8	11.0%	18.2%
	Hatchery Steelhead	110	0.0%	0.0%	9.1%	0.9%	9	8.2%	20.5%
Monthly Total		1483	0.0%	0.0%	1.3%	0.1%	17	1.1%	38.6%
July	Fall Chinook	1300							
Monthly Total		1300	0.0%	0.0%	100.0%	0.0%	1	0.1%	2.3%
August	Fall Chinook	892							
Monthly Total		892	0.0%	0.0%	0.0%	0.0%	0	0.0%	0.0%
Season Totals	Spring Chinook	1904	0.6%	0.1%	0.7%	0.0%	25	1.3%	
	Fall Chinook	3492	0.0%	0.0%	0.0%	0.0%	1	0.0%	
	Wild Steelhead	757	0.1%	0.7%	1.8%	0.0%	18	2.4%	
	Hatchery Steelhead	1106	0.7%	0.5%	1.1%	0.1%	25	2.3%	
Season Total		7259	0.3%	0.2%	0.6%	0.0%	**69**	**1.0%**	
Total number of symptoms in each location			21	12	40	1	74		
% of symptoms in each location			0.0%	0.0%	0.0%	0.0%			

NOTE: GBT symptoms were ranked as follows: 0 = 0% coverage, 1 = 1-5% coverage, 2 = 6-25% coverage, 3 = 26-50% coverage, and 4 = greater than 50% coverage.

* some smolt exhibited multiple symptoms

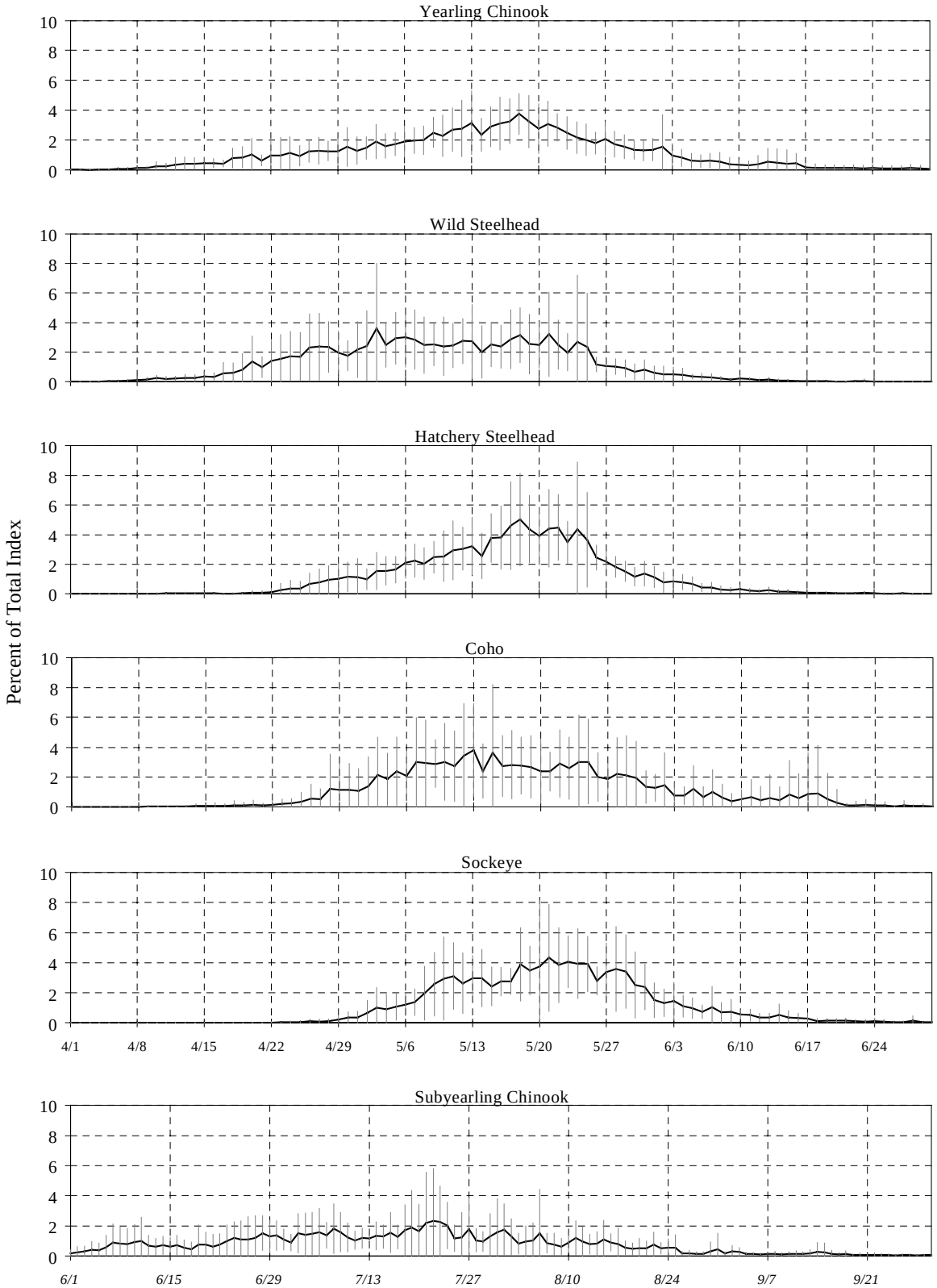

Figure C-1. Historical average passage pattern with standard deviation, John Day Dam, 1985-1998.

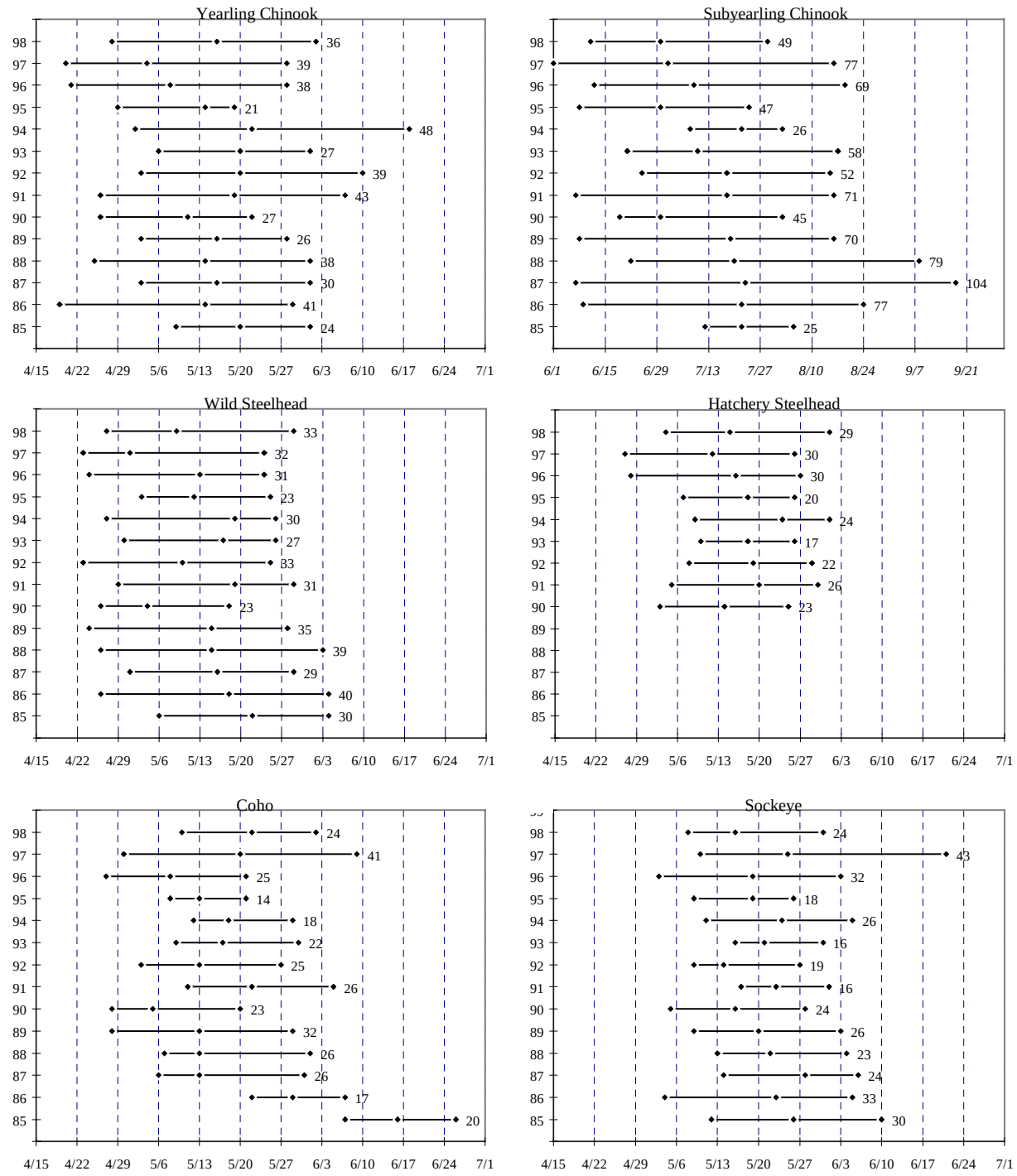

Figure C-2. 10%, 50%, and 90% passage dates at John Day Dam, by species, 1985-1998. The duration between 10-90% dates (in days) is indicated for each line. Hatchery and wild steelhead were not differentiated before 1990.

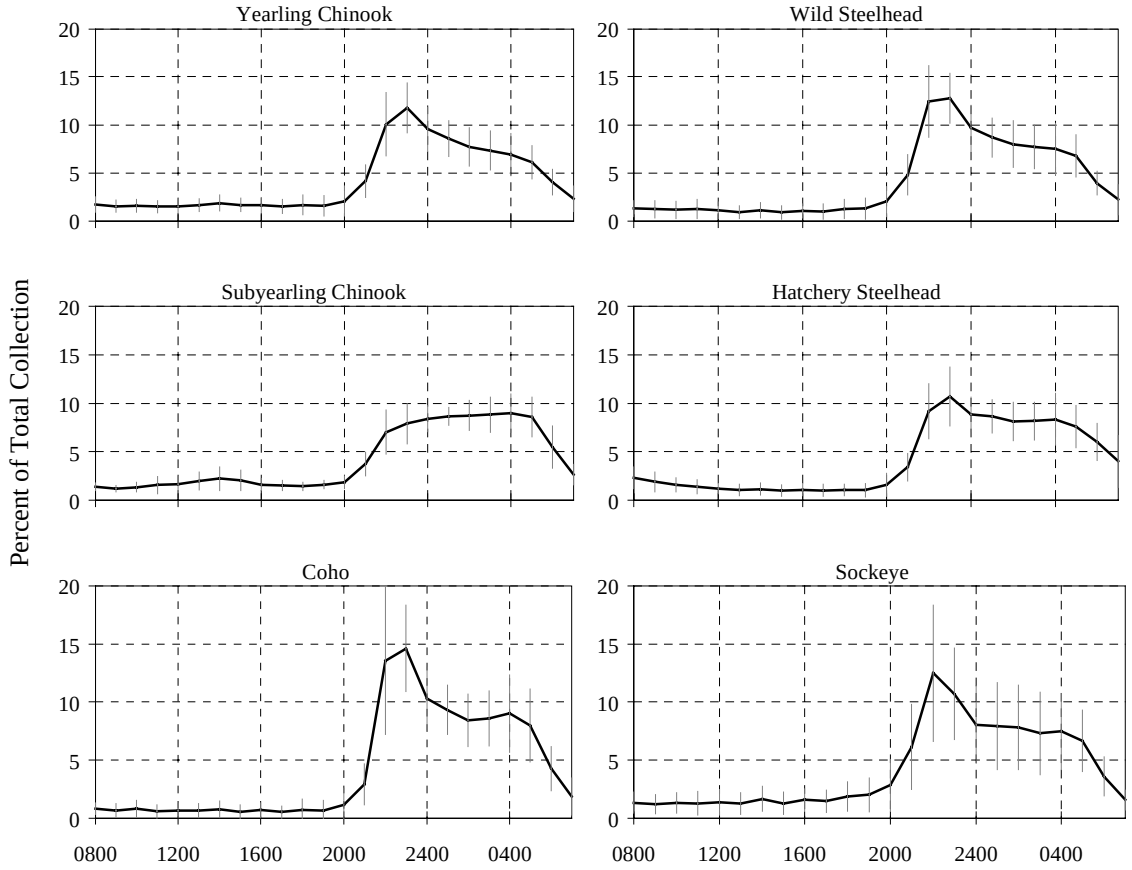

Figure C-3. Historical average diel passage with standard deviation, John Day Dam, 1985-1997. Hourly detail was not collected in 1998.

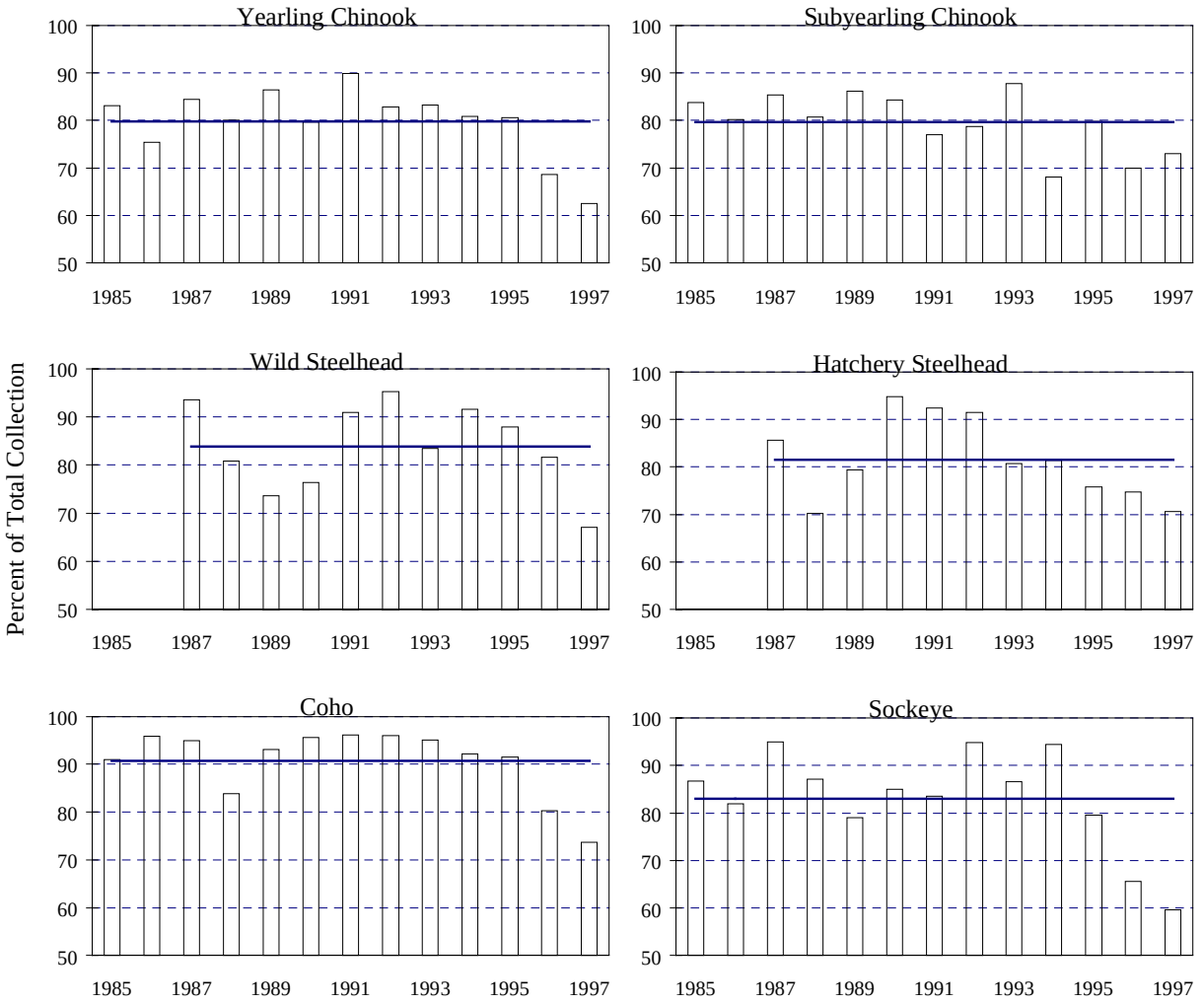

Figure C-4. Percent night passage (1800-0600) for each season at John Day Dam, by species, including the average for all years, 1985-1997. Hourly detail was not collected in 1998.

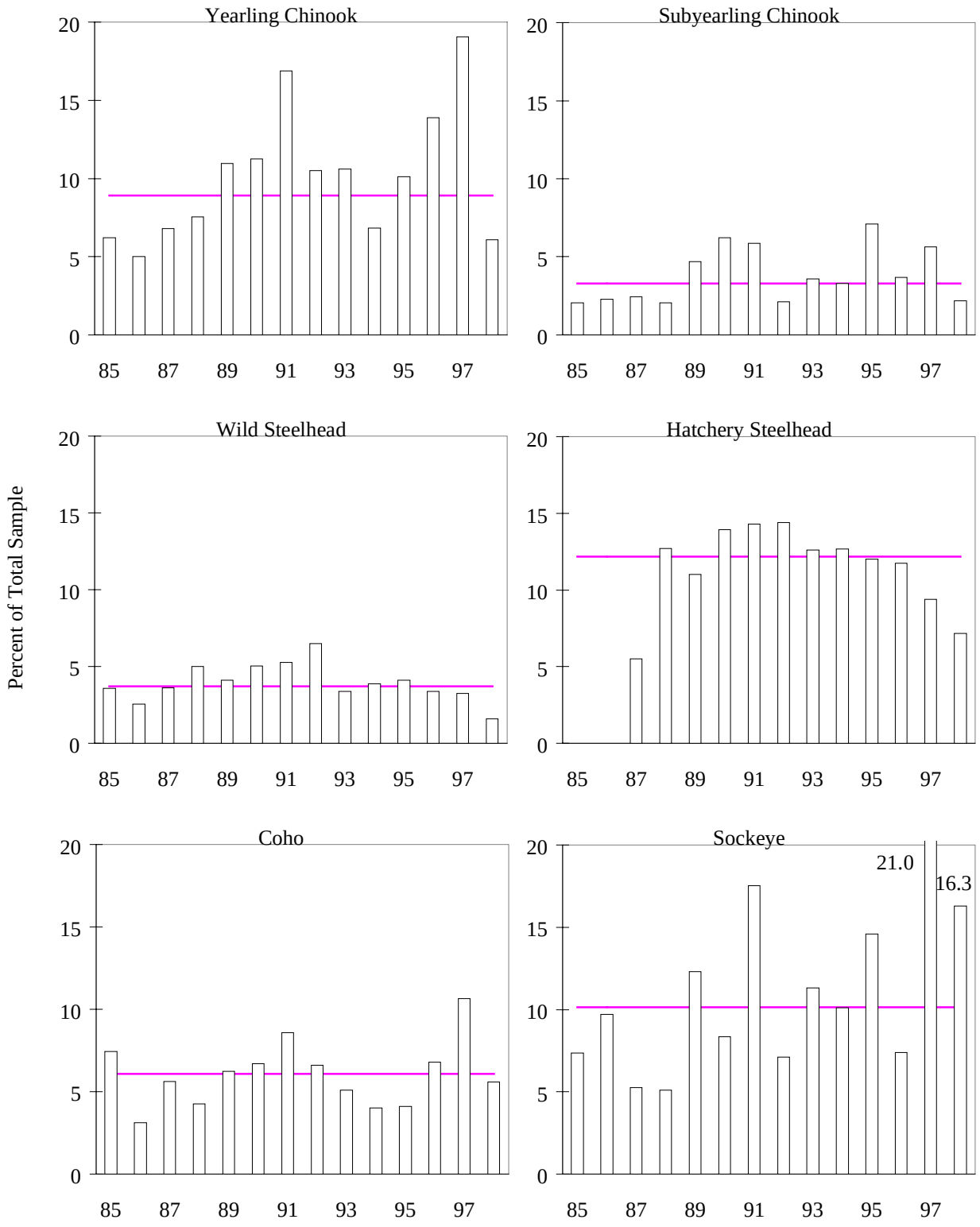

Figure C-5. Historical descaling percentages, John Day Dam, 1985-1998. Hatchery and wild steelhead not differentiated before 1987.

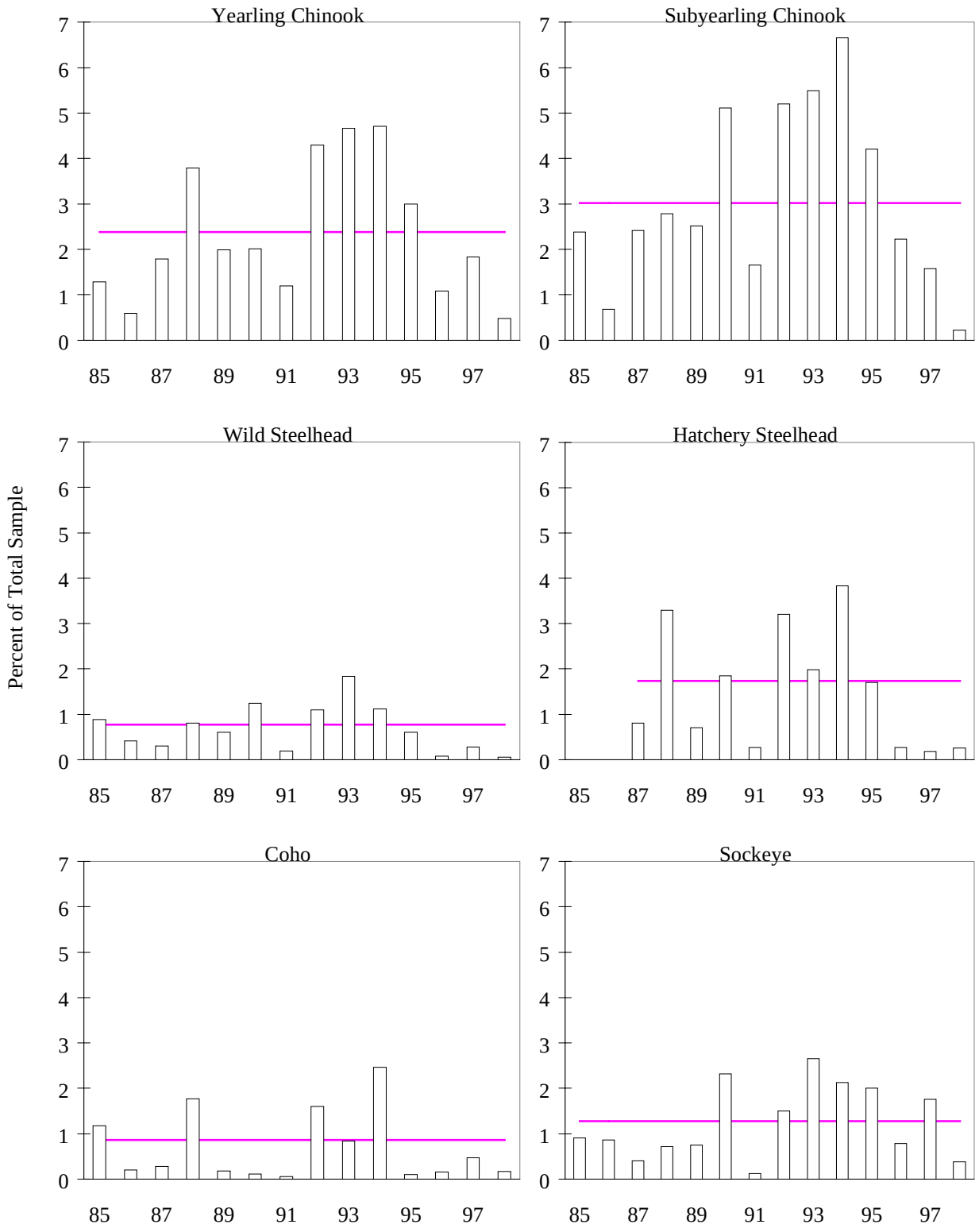

Figure C-6. Historical mortality percentages, John Day Dam, 1985-1998. Hatchery and wild steelhead were not differentiated before 1987.

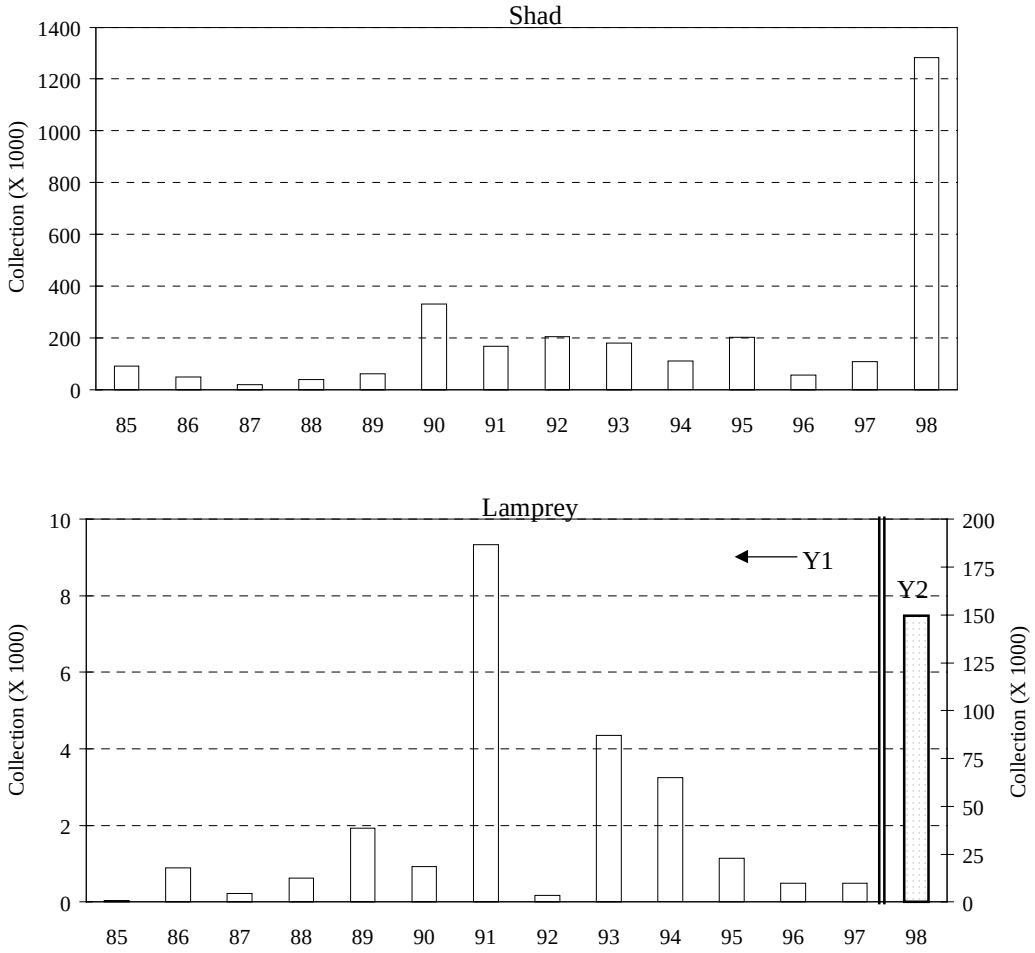

Figure C-7. Historical juvenile shad and lamprey counts at John Day Dam, 1985-1998.

Table C-1. Percent night passage (1800-0600) for each season at John Day Dam, 1985-1997. Hourly detail was not collected in 1998.

YEAR	Yearling Chinook	Subyearling Chinook	Wild Steelhead	Hatchery Steelhead	Coho	Sockeye
1985	83.2	83.7	N/A	N/A	91.0	86.8
1986	75.5	80.1	N/A	N/A	95.9	81.9
1987	84.5	85.4	93.6	85.6	95.0	94.9
1988	80.0	80.7	80.8	70.3	83.9	87.1
1989	86.4	86.2	73.6	79.4	93.0	79.0
1990	79.7	84.4	76.3	94.8	95.6	85.0
1991	89.9	77.0	91.0	92.3	96.2	83.6
1992	82.8	78.7	95.3	91.5	96.0	94.9
1993	83.3	87.8	83.4	80.7	95.1	86.5
1994	80.9	68.1	91.6	81.4	92.2	94.5
1995	80.7	79.7	87.9	75.8	91.5	79.5
1996	68.6	70.0	81.6	74.7	80.2	65.6
1997	62.6	73.1	67.0	70.6	73.7	59.6
AVERAGE	79.8	79.6	83.8	81.5	90.7	83.0
MIN	62.6	68.1	67.0	70.3	73.7	59.6
MAX	89.9	87.8	95.3	94.8	96.2	94.9

Table C-2. 10%, 50%, and 90% passage dates at John Day Dam, 1985 to 1998.

Yearling Chinook				
	10 %	50%	90 %	# of Days
1985^	9-May	20-May	1-Jun	24
1986	19-Apr	14-May	29-May	41
1987	3-May	16-May	1-Jun	30
1988	25-Apr	14-May	1-Jun	38
1989	3-May	16-May	28-May	26
1990^	26-Apr	11-May	22-May	27
1991	26-Apr	19-May	7-Jun	43
1992	3-May	20-May	10-Jun	39
1993	6-May	20-May	1-Jun	27
1994	2-May	22-May	18-Jun	48
1995	29-Apr	14-May	19-May	21
1996	21-Apr	8-May	28-May	38
1997	20-Apr	4-May	28-May	39
1998	28-Apr	16-May	2-Jun	36
MEDIAN	28-Apr	16-May	1-Jun	35
MIN	19-Apr	4-May	19-May	21
MAX	9-May	22-May	18-Jun	48

Subyearling Chinook				
	10 %	50%	90 %	# of Days
1985^	12-Jul	22-Jul	5-Aug	25
1986	9-Jun	22-Jul	24-Aug	77
1987	7-Jun	23-Jul	18-Sep	104
1988	22-Jun	20-Jul	8-Sep	79
1989	8-Jun	19-Jul	16-Aug	70
1990^	19-Jun	30-Jun	2-Aug	45
1991	7-Jun	18-Jul	16-Aug	71
1992	25-Jun	18-Jul	15-Aug	52
1993	21-Jun	10-Jul	17-Aug	58
1994	8-Jul	22-Jul	2-Aug	26
1995	8-Jun	30-Jun	24-Jul	47
1996	12-Jun	9-Jul	19-Aug	69
1997	1-Jun	2-Jul	16-Aug	77
1998	11-Jun	30-Jun	29-Jul	49
MEDIAN	11-Jun	18-Jul	16-Aug	67
MIN	1-Jun	30-Jun	24-Jul	25
MAX	12-Jul	23-Jul	18-Sep	104

Wild Steelhead				
	10 %	50%	90 %	# of Days
1985*^	6-May	22-May	4-Jun	30
1986*	26-Apr	18-May	4-Jun	40
1987*	1-May	16-May	29-May	29
1988*	26-Apr	15-May	3-Jun	39
1989*	24-Apr	15-May	28-May	35
1990^	26-Apr	4-May	18-May	23
1991	29-Apr	19-May	29-May	31
1992	23-Apr	10-May	25-May	33
1993	30-Apr	17-May	26-May	27
1994	27-Apr	19-May	26-May	30
1995	3-May	12-May	25-May	23
1996	24-Apr	13-May	24-May	31
1997	23-Apr	1-May	24-May	32
1998	27-Apr	9-May	29-May	33
MEDIAN	27-Apr	12-May	25-May	29
MIN	23-Apr	1-May	18-May	23
MAX	3-May	19-May	29-May	33

Hatchery Steelhead				
	10 %	50%	90 %	# of Days
1985*^				
1986*				
1987*	ALL STEELHEAD IN WILD			
1988*				
1989*				
1990^	3-May	14-May	25-May	23
1991	5-May	20-May	30-May	26
1992	8-May	19-May	29-May	22
1993	10-May	18-May	26-May	17
1994	9-May	24-May	1-Jun	24
1995	7-May	18-May	26-May	20
1996	28-Apr	16-May	27-May	30
1997	27-Apr	12-May	26-May	30
1998	4-May	15-May	1-Jun	29
MEDIAN	5-May	18-May	27-May	23
MIN	27-Apr	12-May	25-May	17
MAX	10-May	24-May	1-Jun	30

Coho				
	10 %	50%	90 %	# of Days
1985^	7-Jun	16-Jun	26-Jun	20
1986	22-May	29-May	7-Jun	17
1987	6-May	13-May	31-May	26
1988	7-May	13-May	1-Jun	26
1989	28-Apr	13-May	29-May	32
1990^	28-Apr	5-May	20-May	23
1991	11-May	22-May	5-Jun	26
1992	3-May	13-May	27-May	25
1993	9-May	17-May	30-May	22
1994	12-May	18-May	29-May	18
1995	8-May	13-May	21-May	14
1996	27-Apr	8-May	21-May	25
1997	30-Apr	20-May	9-Jun	41
1998	10-May	22-May	2-Jun	24
MEDIAN	7-May	15-May	30-May	24
MIN	27-Apr	5-May	20-May	14
MAX	7-Jun	16-Jun	26-Jun	41

Sockeye (Wild + Hatchery)				
	10 %	50%	90 %	# of Days
1985^	12-May	26-May	10-Jun	30
1986	4-May	23-May	5-Jun	33
1987	14-May	28-May	6-Jun	24
1988	13-May	22-May	4-Jun	23
1989	9-May	20-May	3-Jun	26
1990^	5-May	16-May	28-May	24
1991	17-May	23-May	1-Jun	16
1992	9-May	14-May	27-May	19
1993	16-May	21-May	31-May	16
1994	11-May	24-May	5-Jun	26
1995	9-May	19-May	26-May	18
1996	3-May	19-May	3-Jun	32
1997	10-May	25-May	21-Jun	43
1998	8-May	16-May	31-May	24
MEDIAN	9-May	21-May	3-Jun	26
MIN	3-May	14-May	26-May	16
MAX	17-May	28-May	21-Jun	43

* Years in which no differentiation was made between wild and hatchery steelhead for index purposes.

^ Years in which the sample unit was out of service (1990: May 30 to June 9, and 1985: April 2 to April 26).

Table C-3. Percent of total passage per hour at John Day Dam, 1985-1997. Hourly detail was not collected in 1998.

Yearling Chinook

	0800	0900	1000	1100	Noon	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	MID	0100	0200	0300	0400	0500	0600	0700
1985	0.9	1.1	1.3	1.5	1.1	1.6	1.8	1.7	1.5	1.6	1.6	1.3	1.6	4.9	11.3	11.6	10.8	10.1	8.4	7.5	7.1	6.0	2.5	1.0
1986	1.3	1.6	1.9	1.9	1.9	2.0	2.4	2.3	2.7	2.5	2.5	2.4	3.6	8.4	15.3	13.1	7.5	6.0	4.9	4.3	3.5	3.6	2.6	1.4
1987	1.3	1.0	1.0	0.8	0.8	1.8	1.7	1.6	1.1	0.9	1.1	0.9	1.1	2.4	5.5	11.5	11.0	10.3	9.9	8.9	9.5	8.1	5.5	2.4
1988	2.7	2.1	2.4	0.9	0.9	1.0	1.2	1.1	1.2	1.2	1.0	1.2	1.5	4.2	7.2	9.7	7.8	7.5	8.3	9.2	8.1	8.1	7.2	4.2
1989	2.2	1.1	0.8	0.7	0.8	0.7	0.8	0.7	0.9	0.6	0.8	0.7	0.9	2.8	9.1	12.1	10.6	10.2	9.4	9.5	8.9	6.9	5.5	3.6
1990	1.0	1.7	2.0	1.7	2.0	1.9	2.9	1.5	2.2	1.2	1.4	0.8	1.2	4.3	8.6	10.9	9.7	8.6	8.2	7.9	8.2	7.6	3.6	0.7
1991	0.6	0.5	0.8	0.8	0.9	1.0	1.0	1.0	1.0	0.9	0.8	0.9	1.0	3.2	14.9	17.4	13.9	10.2	7.8	6.6	6.1	4.9	2.9	0.7
1992	1.1	1.3	1.3	2.1	1.9	2.1	1.8	1.5	1.2	1.4	0.7	0.6	0.7	2.4	6.0	11.6	11.7	10.8	10.4	9.5	8.8	6.7	3.5	1.0
1993	2.6	1.7	1.4	1.1	1.0	0.9	0.8	0.8	0.8	1.0	1.1	1.1	1.5	2.8	14.8	16.2	10.3	7.8	7.2	6.1	6.1	5.5	3.9	3.4
1994	1.2	1.3	1.2	1.7	1.5	2.1	2.3	1.9	1.8	1.4	1.3	1.1	1.0	4.1	7.9	8.8	8.9	8.7	9.4	9.3	9.4	8.3	4.0	1.4
1995	1.5	2.1	1.2	1.1	1.0	0.9	1.6	1.6	1.2	1.2	1.8	1.9	2.5	3.3	10.6	10.5	9.8	9.6	7.5	7.5	6.5	6.4	4.5	4.2
1996	2.4	2.2	2.4	2.4	2.7	2.6	3.0	2.9	2.2	2.2	3.6	3.7	5.5	5.9	11.1	11.2	6.9	6.8	4.2	4.0	3.2	3.2	2.9	2.7
1997	3.2	2.8	2.9	2.5	3.2	2.6	3.3	2.8	3.6	3.3	4.0	3.8	4.8	5.3	8.4	8.5	5.2	4.7	4.8	4.6	4.3	4.3	3.9	3.3
AVG	1.6	1.5	1.5	1.4	1.3	1.6	1.8	1.7	1.6	1.5	1.7	1.6	2.1	4.4	10.5	11.9	9.6	8.7	7.7	7.2	6.8	6.1	4.0	2.4
MIN	0.6	0.5	0.8	0.7	0.8	0.7	0.8	0.7	0.8	0.6	0.7	0.6	0.7	2.4	5.5	8.5	5.2	4.7	4.2	4.0	3.2	3.2	2.5	0.7
MAX	3.2	2.8	2.9	2.5	3.2	2.6	3.3	2.9	3.6	3.3	4.0	3.8	5.5	8.4	15.3	17.4	13.9	10.8	10.4	9.5	9.5	8.3	7.2	4.2

Subyearling Chinook

	0800	0900	1000	1100	Noon	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	MID	0100	0200	0300	0400	0500	0600	0700
1985	0.8	1.0	1.3	3.1	1.8	1.3	1.6	1.0	0.9	1.1	1.1	1.0	1.2	5.0	12.1	8.1	8.5	8.7	10.1	7.9	8.9	8.0	4.2	1.2
1986	1.9	1.4	1.3	1.4	1.5	2.5	1.6	1.4	1.2	1.3	1.3	1.4	1.4	4.0	5.4	7.9	8.3	8.8	8.6	8.7	9.4	9.2	7.1	3.1
1987	2.0	0.8	0.9	0.7	0.8	0.8	1.0	1.0	1.1	1.1	1.2	2.0	2.1	4.5	6.7	6.5	7.3	8.7	8.3	9.9	10.0	10.8	8.6	3.1
1988	1.7	1.2	1.1	1.1	1.2	1.8	1.8	1.7	1.4	1.5	1.4	2.1	2.2	5.7	7.6	6.5	6.6	7.4	7.9	8.5	9.5	9.3	7.4	3.3
1989	1.8	1.1	1.1	0.7	0.7	0.6	0.7	0.7	0.9	0.8	0.9	1.0	0.9	2.3	3.3	4.4	6.6	8.5	11.6	12.4	12.9	12.8	9.4	3.8
1990	0.9	0.8	0.8	1.2	1.3	1.7	1.8	1.9	1.8	1.2	1.2	1.2	1.4	2.9	7.3	12.1	11.4	10.1	10.0	9.2	8.1	7.2	3.4	1.1
1991	1.0	0.7	0.8	1.0	1.1	3.3	4.7	4.0	1.9	1.7	1.4	1.5	1.6	3.6	7.5	10.0	8.7	8.2	8.0	8.0	8.3	7.9	3.8	1.4
1992	1.1	1.2	1.3	1.6	1.6	2.9	2.4	2.2	2.2	1.9	1.9	2.2	2.7	5.7	6.2	7.0	7.8	7.9	8.6	9.0	10.1	8.5	3.1	1.1
1993	1.1	0.9	0.9	0.7	0.9	0.8	0.7	0.8	0.8	0.7	0.8	1.0	1.1	2.7	4.2	6.0	8.7	10.0	11.1	12.2	12.1	11.3	7.4	3.0
1994	1.5	1.9	2.1	3.3	3.7	3.6	3.7	3.3	2.2	1.9	1.7	1.7	3.2	4.2	6.4	7.0	7.0	7.1	6.1	6.3	7.7	7.1	4.3	3.1
1995	1.1	1.1	1.6	1.1	1.6	1.6	1.9	1.9	1.9	1.8	2.1	2.1	1.8	2.4	10.1	10.5	9.7	10.0	8.2	8.0	6.8	6.7	3.5	2.6
1996	1.6	1.5	2.4	2.3	2.2	2.2	3.1	3.2	2.7	2.7	2.1	2.0	2.2	2.5	6.2	7.9	9.4	8.3	7.6	7.0	6.0	6.0	4.8	4.1
1997	1.5	1.3	2.0	1.9	2.6	2.5	3.7	3.0	1.8	1.8	1.6	1.5	1.8	2.8	8.1	8.8	9.2	8.4	7.5	7.3	7.0	6.6	4.0	3.1
AVG	1.4	1.2	1.3	1.7	1.6	1.8	1.9	1.7	1.4	1.4	1.3	1.5	1.7	3.9	7.4	7.5	8.1	8.6	8.9	8.8	9.3	8.9	5.9	2.7
MIN	0.8	0.7	0.8	0.7	0.7	0.6	0.7	0.7	0.8	0.7	0.8	1.0	0.9	2.3	3.3	4.4	6.6	7.1	6.1	6.3	6.0	6.0	3.1	1.1
MAX	2.0	1.9	2.4	3.3	3.7	3.6	4.7	4.0	2.7	2.7	2.1	2.2	3.2	5.7	12.1	12.1	11.4	10.1	11.6	12.4	12.9	12.8	9.4	4.1

Wild Steelhead

	0800	0900	1000	1100	Noon	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	MID	0100	0200	0300	0400	0500	0600	0700
1985	1.0	0.8	0.8	0.8	0.7	0.9	1.0	0.8	0.7	0.7	0.7	0.7	0.9	3.0	9.6	10.7	10.1	10.9	9.9	10.0	10.1	9.2	4.2	1.6
1986	2.0	1.4	1.3	0.9	0.8	0.8	1.1	0.9	1.0	1.1	1.2	1.5	3.0	6.4	10.8	13.0	9.8	8.1	7.6	6.7	5.6	5.9	5.9	3.1
1987	0.7	0.4	0.5	0.4	0.5	0.4	0.6	0.3	0.6	0.2	0.4	0.3	0.5	2.7	10.9	13.4	11.2	10.7	9.6	10.1	10.7	8.7	5.1	1.5
1988	1.2	2.4	2.9	1.3	1.5	1.3	2.0	1.0	1.2	1.0	0.9	1.5	2.0	4.9	8.1	10.5	8.0	7.8	8.5	8.6	8.0	7.7	5.2	2.5
1989	2.5	1.8	2.1	3.1	2.9	1.8	2.1	1.8	2.0	2.3	2.3	3.1	3.5	7.3	12.8	9.1	6.7	6.5	5.8	6.0	5.6	4.6	2.7	1.9
1990	0.4	0.3	0.7	0.2	0.4	0.2	0.7	0.2	0.5	0.2	0.6	0.2	0.7	7.3	15.7	15.7	11.1	8.1	8.8	7.6	9.2	7.7	2.9	0.4
1991	1.1	0.6	0.7	0.6	1.0	0.5	0.7	0.3	0.6	0.9	0.8	1.4	1.9	6.0	18.0	16.1	11.4	9.1	6.5	7.2	5.8	5.4	2.1	1.1
1992	0.3	0.5	0.3	0.4	0.4	0.5	0.3	0.4	0.3	0.6	0.2	0.1	0.3	2.1	8.1	13.0	13.7	12.4	12.6	11.1	9.9	8.7	3.3	0.6
1993	1.9	1.5	1.1	1.2	1.1	1.1	1.1	1.2	1.4	1.2	1.4	1.5	2.2	6.5	17.2	14.8	8.9	6.9	6.5	5.0	5.0	5.3	3.6	2.3
1994	0.7	0.6	0.5	2.6	0.4	0.4	0.3	0.5	0.5	0.4	0.4	0.5	0.6	2.4	8.1	11.4	10.8	9.3	11.0	10.8	12.0	10.7	3.9	1.1
1995	0.8	1.3	0.5	0.5	0.2	0.4	0.4	0.4	0.6	0.5	0.9	0.7	1.6	2.3	12.7	12.8	10.3	10.3	8.1	8.0	7.5	7.4	6.1	5.5
1996	1.5	1.6	1.1	1.2	1.4	1.2	1.4	1.3	1.4	1.0	2.1	2.0	3.8	4.3	15.3	15.1	9.0	8.9	6.2	5.9	3.9	3.6	3.7	3.1
1997	2.9	3.0	2.3	2.4	2.4	2.2	2.6	2.3	2.6	2.6	3.5	3.2	5.2	6.8	9.8	8.7	5.4	5.3	4.3	4.4	4.7	4.4	4.6	4.3
AVG	1.4	1.3	1.2	1.3	1.1	0.9	1.1	0.9	1.1	1.0	1.3	1.4	2.2	4.7	12.8	12.8	9.4	8.6	7.7	7.4	7.2	6.5	4.2	2.5
MIN	0.3	0.3	0.3	0.2	0.2	0.2	0.3	0.2	0.3	0.2	0.2	0.1	0.3	2.1	8.1	8.7	5.4	5.3	4.3	4.4	3.9	3.6	2.1	0.4
MAX	2.9	3.0	2.9	3.1	2.9	2.2	2.6	2.3	2.6	2.6	3.5	3.2	5.2	7.3	18.0	16.1	13.7	12.4	12.6	11.1	12.0	10.7	6.1	5.5

Hatchery Steelhead

	0800	0900	1000	1100	Noon	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	MID	0100	0200	0300	0400	0500	0600	0700
1985																								
1986																								
1987	1.9	1.1	1.3	0.7	0.9	0.6	1.0	0.7	0.9	0.7	0.9	0.6	0.9	2.3	6.0	9.7	8.4	8.8	9.8	10.2	10.9	10.0	7.9	3.7
1988	2.8	3.0	3.1	2.2	1.8	2.1	2.6	2.0	2.1	1.7	1.5	1.5	2.0	6.0	6.9	7.6	6.5	6.6	5.7	6.6	7.2	6.6	6.9	5.0
1989	3.5	1.9	1.6	1.5	1.3	0.9	1.0	1.0	0.8	0.7	0.8	0.8	0.9	2.5	9.7	9.3	7.6	8.3	8.1	8.3	8.5	7.8	7.6	5.5
1990	0.5	0.2	0.7	0.1	0.4	0.2	0.8	0.1	0.6	0.1	0.7	0.3	0.9	3.2	10.5	12.5	10.1	9.8	9.2	9.4	11.4	11.6	5.9	0.9
1991	0.9	0.7	0.8	0.6	0.5	0.5	0.6	0.4	0.5	0.5	0.7	1.1	1.5	5.2	13.8	15.0	12.0	10.0	8.6	7.5	6.9	6.5	4.3	1.0
1992	0.9	0.8	0.6	0.9	0.9	0.9	0.5	0.4	0.4	1.1	0.6	0.2	0.3	2.2	6.4	12.3	11.6	12.7	12.0	11.5	11.3	7.9	3.1	0.7
1993	3.8	2.4	1.8	1.5	1.5	0.9	0.9	0.8	0.8	0.7	0.7	0.8	1.2	3.3	13.1	16.2	9.4	8.0	6.7	6.3	6.0	5.7	4.1	3.5
1994	2.3	2.1	1.5	2.3	1.1	1.1	1.0	1.3	1.3	1.0	1.0	0.9	1.0	3.7	6.5	7.8	8.5	8.0	8.8	9.9	11.3	9.2	5.8	2.8
1995	3.3	4.2	1.4	1.3	0.6	0.6	0.6	0.7	0.6	0.5	0.6	0.6	0.9	1.1	6.5	6.6	7.8	7.8	8.5	8.4	8.9	8.9	9.8	9.7
1996	2.5	2.5	1.9	1.9	1.5	1.6	1.5	1.6	1.5	1.6	1.5	1.7	3.5	3.4	10.2	10.4	8.7	8.5	6.6	6.5	4.8	4.9	5.7	5.8
1997	2.6	2.5	2.2	2.1	2.1	2.0	1.9	1.8	2.2	2.2	2.5	2.7	4.1	4.5	11.4	10.5	6.6	6.5	5.1	5.2	4.4	4.5	5.1	5.1
AVG	2.5	2.3	1.5	1.4	1.1	1.0	1.1	1.0	1.0	1.0	1.0	1.1	1.8	3.4	9.6	10.8	8.8	8.4	7.8	7.7	7.5	7.1	6.2	4.8
MIN	0.5	0.2	0.6	0.1	0.4	0.2	0.5	0.1	0.4	0.1	0.6	0.2	0.3	1.1	6.0	6.6	6.5	6.5	5.1	5.2	4.4	4.5	3.1	0.7
MAX	3.8	4.2	3.1	2.3	2.1	2.1	2.6	2.0	2.2	2.2	2.5	2.7	4.1	6.4	13.8	16.2	12.0	12.7	12.0	11.5	11.3	9.8	9.7	

Table C-3. Continued.

Coho

	0800	0900	1000	1100	Noon	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	MID	0100	0200	0300	0400	0500	0600	0700
1985	0.7	0.5	1.5	0.3	0.5	0.7	0.5	0.3	1.7	0.8	0.7	0.0	1.3	1.8	5.0	12.4	11.7	13.4	13.4	11.5	10.5	6.7	3.2	0.8
1986	0.2	0.3	0.4	0.1	0.6	0.6	0.6	0.4	0.2	0.1	0.3	0.4	0.7	1.1	9.9	22.2	16.7	12.3	9.1	8.4	7.1	6.1	1.9	0.6
1987	0.6	0.5	0.7	0.2	0.3	0.2	0.3	0.1	0.3	0.1	0.3	0.1	0.3	0.5	7.1	11.0	9.4	10.8	10.6	11.0	12.6	13.6	7.9	1.4
1988	1.5	2.1	1.9	1.1	0.7	1.1	1.8	1.0	1.1	0.7	0.6	0.5	0.8	3.3	7.7	11.3	8.0	8.2	8.2	9.4	10.0	9.5	6.9	2.6
1989	1.0	0.4	0.7	0.4	0.5	0.4	0.7	0.2	0.3	0.3	0.4	0.5	0.6	6.2	15.8	13.4	10.8	9.9	8.3	8.5	8.0	7.0	4.1	1.7
1990	0.3	0.2	0.5	0.2	0.6	0.3	0.8	0.2	0.5	0.2	0.4	0.0	0.3	2.5	10.2	11.6	9.1	7.8	9.1	11.3	15.3	13.3	5.2	0.3
1991	0.2	0.3	0.3	0.3	0.4	0.3	0.4	0.1	0.5	0.3	0.5	0.5	1.2	4.3	25.0	18.0	12.7	8.2	6.9	6.6	6.2	5.0	1.5	0.4
1992	0.3	0.1	0.2	0.5	0.3	0.4	0.2	0.5	0.3	0.6	0.4	0.3	0.2	3.2	12.8	15.6	11.6	10.3	9.9	9.2	11.4	8.4	3.2	0.3
1993	1.0	0.4	0.3	0.3	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.3	0.5	3.8	24.4	17.1	11.8	9.4	6.8	6.4	5.9	5.6	3.2	2.0
1994	0.9	0.7	0.4	0.6	0.5	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	1.7	10.4	10.4	9.1	8.3	9.6	12.0	12.6	11.9	5.2	1.8
1995	0.6	0.8	0.2	0.2	0.1	0.2	0.2	0.2	0.1	0.1	0.2	0.1	0.4	0.5	19.9	19.8	8.6	8.5	6.4	6.4	7.5	7.5	5.8	5.6
1996	1.3	1.2	1.3	1.3	1.6	1.6	1.6	1.6	1.2	1.1	1.6	1.6	2.9	3.5	14.7	14.6	8.9	8.9	5.4	5.4	4.9	4.7	4.6	4.3
1997	1.7	1.4	2.3	2.1	2.3	2.1	2.5	2.0	2.1	1.9	3.5	3.4	5.2	5.4	13.1	12.3	5.7	5.0	5.5	5.5	4.9	4.8	2.8	2.5
AVG	0.9	0.8	0.8	0.7	0.7	0.7	0.8	0.7	0.6	0.5	0.8	0.7	1.3	2.7	14.7	14.7	9.4	8.8	7.5	7.9	8.4	8.0	5.0	2.9
MIN	0.2	0.1	0.2	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.0	0.2	0.5	5.0	10.4	5.7	5.0	5.4	5.4	4.9	4.7	1.5	0.3
MAX	1.7	2.1	2.3	2.1	2.3	2.1	2.5	2.0	2.1	1.9	3.5	3.4	5.2	6.2	25.0	22.2	16.7	13.4	13.4	12.0	15.3	13.6	7.9	5.6

Sockeye

	0800	0900	1000	1100	Noon	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	MID	0100	0200	0300	0400	0500	0600	0700
1985	0.8	0.8	1.0	1.1	1.0	1.5	1.6	1.1	1.1	1.1	1.2	1.1	1.2	5.5	12.2	10.1	10.7	10.4	9.2	8.2	8.9	7.1	2.1	1.0
1986	1.0	1.5	1.4	1.4	1.5	1.6	1.8	1.6	1.5	1.8	2.1	2.6	3.2	7.1	14.1	12.6	9.7	7.3	7.5	5.6	4.8	4.4	3.0	1.0
1987	0.3	0.4	0.6	0.3	0.4	0.2	0.5	0.3	0.4	0.3	0.5	0.2	0.4	1.1	5.2	8.7	12.1	14.5	13.6	12.3	12.1	10.0	4.8	0.8
1988	1.2	1.1	1.3	0.7	0.6	0.6	1.3	1.0	1.3	0.6	0.7	0.4	0.9	2.4	4.9	7.3	6.8	8.8	12.3	13.0	11.9	10.3	8.0	2.5
1989	2.7	1.6	2.1	2.0	1.6	1.5	1.9	1.5	1.6	1.1	1.6	1.5	1.6	5.9	13.0	8.1	5.5	6.7	6.4	8.2	8.6	8.5	4.9	1.8
1990	1.2	0.8	1.8	0.8	1.5	0.6	2.5	0.5	2.0	0.7	1.5	1.2	2.4	8.8	12.2	8.6	9.1	7.9	8.0	7.9	9.2	7.2	2.4	1.0
1991	1.2	0.8	1.1	1.1	1.3	1.6	1.3	0.8	1.8	1.9	2.2	3.1	4.8	11.6	16.8	9.0	7.0	5.9	6.1	5.1	6.4	5.5	2.3	1.3
1992	0.4	0.2	0.2	0.6	0.3	0.3	0.6	0.4	0.4	0.6	0.3	0.5	0.5	2.6	10.9	12.0	11.5	13.6	11.9	11.0	9.7	8.4	2.2	0.6
1993	0.6	0.7	0.7	1.0	1.0	1.2	0.9	1.0	1.5	2.1	2.8	3.2	3.4	13.5	24.3	11.7	5.1	3.7	3.6	4.6	4.8	5.5	3.3	1.2
1994	0.6	0.4	0.4	0.4	0.3	0.4	0.4	0.4	0.4	0.4	0.5	0.7	0.8	1.9	8.0	10.6	14.0	11.9	11.3	9.8	10.7	9.4	5.2	0.9
1995	1.3	1.5	1.0	1.0	1.0	1.1	1.6	1.6	2.2	2.1	3.4	3.4	5.2	5.2	22.5	22.6	3.8	3.7	2.4	2.4	3.0	2.7	2.7	2.7
1996	2.7	3.0	2.3	1.9	2.6	1.9	3.7	3.5	2.8	2.7	4.2	4.2	7.3	7.7	10.5	9.9	4.9	4.3	3.7	3.2	4.0	3.3	2.6	3.2
1997	3.0	2.6	3.3	4.3	4.4	3.8	3.6	2.9	3.5	3.4	3.4	4.2	5.4	6.4	7.9	7.9	4.4	4.0	5.6	3.5	3.2	3.8	3.2	2.2
AVG	1.0	1.1	1.1	1.1	1.1	1.2	1.4	1.2	1.4	1.4	1.9	2.1	2.7	6.1	14.4	12.4	8.1	7.8	7.4	6.9	7.0	6.2	3.5	1.5
MIN	0.3	0.2	0.2	0.3	0.3	0.2	0.4	0.3	0.4	0.3	0.3	0.2	0.4	1.1	4.9	7.3	3.8	3.7	2.4	2.4	3.0	2.7	2.1	0.6
MAX	3.0	3.0	3.3	4.3	4.4	3.8	3.7	3.5	3.5	3.4	4.2	4.2	7.3	13.5	24.3	22.6	14.0	14.5	13.6	13.0	12.1	10.3	8.0	3.2

All Species Combined

	0800	0900	1000	1100	Noon	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	MID	0100	0200	0300	0400	0500	0600	0700
1985	0.8	1.0	1.3	2.5	1.5	1.3	1.5	1.1	1.0	1.2	1.2	1.0	1.2	4.8	11.7	9.1	9.2	9.3	9.7	8.0	8.7	7.7	3.8	1.2
1986	1.7	1.4	1.5	1.5	1.5	2.1	1.8	1.6	1.6	1.7	1.7	1.7	2.3	5.7	9.3	10.3	8.3	7.9	7.4	7.1	7.1	7.0	5.4	2.5
1987	1.5	0.8	0.9	0.7	0.8	1.1	1.2	1.1	1.0	0.9	1.0	1.2	1.4	3.1	6.4	9.2	9.3	9.8	9.4	9.8	10.1	9.8	7.0	2.6
1988	2.0	1.6	1.6	1.1	1.1	1.5	1.7	1.5	1.4	1.4	1.3	1.7	1.9	5.1	7.4	7.5	6.8	7.4	8.1	8.8	9.2	8.9	7.4	3.5
1989	2.0	1.2	1.1	0.9	0.9	0.7	0.8	0.8	0.9	0.8	0.9	1.0	1.0	2.9	5.8	6.7	7.5	8.7	10.5	11.1	11.3	10.8	8.0	3.7
1990	0.8	1.0	1.2	1.1	1.3	2.9	1.9	1.4	1.7	1.0	1.1	0.9	1.2	3.7	8.6	11.7	10.4	9.2	9.0	8.7	8.8	8.0	3.7	0.8
1991	0.8	0.6	0.8	0.9	0.9	2.0	2.7	2.3	1.4	1.2	1.1	1.3	1.5	4.1	12.0	13.3	10.8	8.9	7.8	7.4	7.2	6.6	3.3	1.1
1992	1.0	1.1	1.1	1.6	1.5	2.2	1.8	1.7	1.5	1.5	1.3	1.3	1.6	4.1	6.7	9.6	9.8	9.6	9.7	9.5	9.9	7.9	3.2	1.0
1993	2.1	1.5	1.2	1.0	1.0	0.8	0.8	0.8	0.8	0.9	1.0	1.2	1.4	3.9	12.0	12.2	9.1	8.3	8.1	8.1	8.0	7.6	5.1	3.0
1994	1.4	1.7	1.7	2.6	2.7	2.7	2.8	2.5	1.9	1.5	1.4	1.4	2.3	3.8	7.0	7.9	8.0	7.8	7.4	7.7	8.8	8.0	4.4	2.5
1995	1.6	2.1	1.2	1.1	1.0	1.0	1.3	1.3	1.2	1.2	1.6	1.6	1.9	2.5	11.1	11.3	8.9	8.9	7.5	7.5	7.0	6.9	5.4	4.9
1996	2.0	1.9	2.0	2.0	2.0	2.0	2.4	2.4	2.0	1.9	2.3	2.3	3.6	3.9	10.4	10.9	8.4	8.1	6.0	5.8	4.7	4.6	4.4	4.1
1997	2.3	2.1	2.2	2.2	2.4	2.3	2.8	2.3	2.3	2.2	2.5	2.6	3.7	4.4	10.0	9.7	7.1	6.6	5.8	5.7	5.3	5.1	4.3	4.0
AVG	1.8	1.6	1.5	1.7	1.5	1.8	1.8	1.6	1.5	1.4	1.5	1.6	2.1	4.5	10.3	10.8	9.5	9.4	9.1	8.9	9.0	8.5	5.8	3.1
MIN	0.8	0.6	0.8	0.7	0.8	0.7	0.8	0.8	0.8	0.8	0.9	0.9	1.0	2.5	5.8	6.7	6.8	6.6	5.8	5.7	4.7	4.6	3.2	0.8
MAX	2.3	2.1	2.2	2.6	2.7	2.9	2.8	2.5	2.3	2.2	2.5	2.6	3.7	5.7	12.0	13.3	10.8	9.8	10.5	11.1	11.3	10.8	8.0	4.9

Table C-4. Descaling and mortality data from John Day Dam, 1985-1998.

	YEARLING CHINOOK					SUBYEARLING CHINOOK				
YEAR	SAMPLE	DESC	%DESC	MORT	%MORT	SAMPLE	DESC	%DESC	MORT	%MORT
1985	62,790	3,846	6.2	809	1.3	228,211	4,567	2.0	5,425	2.4
1986	92,856	4,630	5.0	547	0.6	181,857	4,135	2.3	1,231	0.7
1987	84,312	5,617	6.8	1,505	1.8	95,693	2,290	2.5	2,313	2.4
1988	34,071	2,470	7.5	1,292	3.8	109,435	2,186	2.1	3,050	2.8
1989	34,935	3,749	10.9	694	2.0	129,957	5,922	4.7	3,273	2.5
1990	26,907	2,968	11.3	541	2.0	39,280	2,316	6.2	2,009	5.1
1991	26,879	4,487	16.9	320	1.2	46,785	2,696	5.9	775	1.7
1992	42,231	4,256	10.5	1,823	4.3	59,783	1,216	2.1	3,096	5.2
1993	52,821	5,342	10.6	2,464	4.7	116,804	3,954	3.6	6,413	5.5
1994	34,071	2,219	6.8	1,606	4.7	75,164	2,309	3.3	5,004	6.7
1995	34,308	3,361	10.1	1,032	3.0	48,896	3,325	7.1	2,029	4.2
1996	14,560	2,001	13.9	158	1.1	31,157	1,119	3.7	692	2.2
1997	4,586	859	19.1	84	1.8	20,487	1,133	5.6	322	1.6
1998	27,732	1,675	6.1	133	0.5	31,178	678	2.2	70	0.2
TOTAL	545,327	47,480	8.9	13,008	2.4	1,183,509	37,846	3.3	35,702	3.0

	WILD STEELHEAD					HATCHERY STEELHEAD				
YEAR	SAMPLE	DESC	%DESC	MORT	%MORT	SAMPLE	DESC	%DESC	MORT	%MORT
1985	36,355	1,292	3.6	320	0.9					
1986	37,858	962	2.6	156	0.4					
1987	12,374	447	3.6	41	0.3	11,622	634	5.5	94	0.8
1988	6,810	335	5.0	56	0.8	8,227	1,012	12.7	268	3.3
1989	8,585	348	4.1	53	0.6	11,229	1,225	11.0	84	0.7
1990	6,104	303	5.0	76	1.2	4,867	665	13.9	90	1.8
1991	5,455	287	5.3	10	0.2	11,171	1,593	14.3	30	0.3
1992	5,141	332	6.5	54	1.1	11,970	1,663	14.4	389	3.2
1993	16,042	530	3.4	294	1.8	52,936	6,562	12.6	1,049	2.0
1994	7,604	290	3.9	85	1.1	14,454	1,761	12.7	554	3.8
1995	4,043	166	4.1	26	0.6	18,915	2,236	12.0	325	1.7
1996	3,973	134	3.4	3	0.1	11,171	1,310	11.8	30	0.3
1997	4,011	130	3.3	11	0.3	13,645	1,279	9.4	24	0.2
1998	8,378	132	1.6	4	0.0	6,214	444	7.2	16	0.3
TOTAL	154,355	5,688	3.7	1,189	0.8	170,207	20,384	12.2	2,953	1.7

	COHO					SOCKEYE				
YEAR	SAMPLE	DESC	%DESC	MORT	%MORT	SAMPLE	DESC	%DESC	MORT	%MORT
1985	598	44	7.4	7	1.2	17,246	1,258	7.4	157	0.9
1986	1,990	62	3.1	4	0.2	17,539	1,688	9.7	151	0.9
1987	13,213	741	5.6	36	0.3	11,923	624	5.3	48	0.4
1988	8,680	363	4.3	153	1.8	6,336	320	5.1	45	0.7
1989	6,934	431	6.2	12	0.2	5,497	672	12.3	41	0.7
1990	6,261	418	6.7	7	0.1	1,769	144	8.3	41	2.3
1991	5,104	437	8.6	3	0.1	3,447	604	17.5	4	0.1
1992	9,804	636	6.6	158	1.6	2,608	183	7.1	39	1.5
1993	13,164	669	5.1	110	0.8	14,885	1,630	11.3	397	2.7
1994	11,385	446	4.0	281	2.5	7,270	719	10.1	155	2.1
1995	5,908	244	4.1	8	0.1	5,625	807	14.6	112	2.0
1996	8,551	579	6.8	13	0.2	1,147	84	7.4	9	0.8
1997	3,409	361	10.6	16	0.5	738	152	21.0	13	1.8
1998	5,330	297	5.6	9	0.2	4,479	726	16.3	17	0.4
TOTAL	95,001	5,728	6.1	817	0.9	96,030	9,611	10.1	1,229	1.3

Table C-5. Condition subsampling data, expressed as a percent of sample, from John Day Dam, 1985-1998.

YEAR	NO.	INJURY			DISEASE				BIRD	3-19%
	SMPLD	HEAD	OPERC.	BODY	PAR.	COL.	FUN.	BKD	PRED	DESC
Yearling Chinook										
1985	981	0.92	N/A	1.94	N/A	N/A	N/A	N/A	N/A	10.19
1986	950	1.37	N/A	2.11	N/A	N/A	N/A	N/A	N/A	20.11
1987	1,957	0.36	N/A	1.07	N/A	N/A	N/A	N/A	N/A	15.94
1988	1,870	0.75	0.48	1.34	0.11	N/A	0.8	N/A	0.37	12.03
1989	1,313	1.68	1.07	3.12	0.53	N/A	0.76	0.38	0.53	13.02
1990	1,143	0.26	1.05	0.7	0.09	N/A	0.96	0.61	0.35	20.65
1991	1,959	0.71	0.26	0.46	0.2	N/A	0.56	0.71	1.58	14.34
1992	1,507	0.6	0.13	0.33	0.07	N/A	1.33	0.86	1.39	10.95
1993	3,995	N/A	0.8	2.95	0.35	0.33	0.38	N/A	1.05	15.52
1994	3,879	N/A	0.18	6.21	0.03	0.75	0.85	N/A	1.47	14.54
1995	2,573	2.18	1.63	2.91	1.52	0.31	1.67	2.64	2.37	21.45
1996	2,596	0.58	0.58	1.5	0.5	0.04	0.15	0.39	1.16	28.58
1997	1,509	0.40	0.40	2.32	1.19	0.00	0.27	0.73	1.59	17.30
1998	2,606	0.27	0.58	0.54	0.12	0.08	0.69	0.88	1.07	11.24
Wild Steelhead										
1985	96	2.08	N/A	2.08	N/A	N/A	N/A	N/A	N/A	7.29
1986	230	1.3	N/A	3.48	N/A	N/A	N/A	N/A	N/A	8.26
1987	750	0.13	N/A	0.93	N/A	N/A	N/A	N/A	N/A	11.87
1988	1,080	0.09	N/A	0.28	0.09	N/A	0.46	N/A	0.37	5.93
1989	1,159	0.09	0.26	1.04	0.17	N/A	0.17	N/A	0.69	6.47
1990	476	0.42	0.84	0.21	2.1	N/A	1.47	N/A	1.26	14.71
1991	899	0.44	1	0.67	7.45	N/A	N/A	0.33	1.67	7.56
1992	863	0.12	0.58	1.16	3.01	N/A	0.58	0.23	1.74	6.6
1993	2,265	N/A	0.75	1.41	2.65	0.49	0.26	N/A	1.81	10.95
1994	1,605	N/A	0.19	2.87	2.24	N/A	1.43	N/A	2.55	8.66
1995	1,131	2.48	1.33	1.86	15.21	0.18	2.21	0.18	3.45	11.41
1996	1,126	0.89	1.15	1.78	3.46	0	0.27	0	2.49	18.12
1997	1,035	0.40	0.40	2.32	2.22	0.00	0.58	0.10	2.42	9.76
1998	1,707	0.18	0.12	0.06	2.40	0.06	0.23	0.00	1.82	3.57
Coho										
1985	96	2.08	N/A	2.08	N/A	N/A	N/A	N/A	N/A	7.29
1986	230	1.3	N/A	3.48	N/A	N/A	N/A	N/A	N/A	8.26
1987	750	0.13	N/A	0.93	N/A	N/A	N/A	N/A	N/A	11.87
1988	1,080	0.09	N/A	0.28	0.09	N/A	0.46	N/A	0.37	5.93
1989	1,159	0.09	0.26	1.04	0.17	N/A	0.17	N/A	0.69	6.47
1990	849	N/A	N/A	1.3	N/A	N/A	1.18	N/A	1.06	13.43
1991	844	N/A	0.24	0.36	0.12	N/A	0.12	0.12	0.47	14.34
1992	834	0.36	N/A	0.48	N/A	N/A	0.72	N/A	0.96	9.11
1993	2,166	N/A	0.51	0.88	0.14	0.18	0.05	N/A	1.39	8.36
1994	1,450	N/A	0.07	2.69	0.14	0.14	0.28	N/A	2.69	9.66
1995	1,026	0.39	0.1	0.39	0.29	N/A	0.19	N/A	3.8	10.23
1996	1,738	1.09	0.69	1.38	0.46	0	0.23	0	1.55	21.52
1997	1,070	0.65	0.37	0.93	0.65	0.00	0.65	0.19	2.99	14.95
1998	1,374	0.15	0.51	0.36	0.00	0.07	0.29	0.07	1.82	5.90

YEAR	NO.	INJURY			DISEASE				BIRD	3-19%
	SMPLD	HEAD	OPERC.	BODY	PAR.	COL.	FUN.	BKD	PRED	DESC
Subyearling Chinook										
1985	2,707	1.81	N/A	1.55	0.04	N/A	0.92	N/A	N/A	7.35
1986	3,517	0.65	N/A	3.18	N/A	N/A	0.77	N/A	N/A	9.01
1987	4,407	0.34	N/A	3.36	N/A	N/A	N/A	N/A	N/A	11.64
1988	4,710	0.25	0.23	0.98	N/A	N/A	12.85	N/A	0.08	8.79
1989	2,997	0.17	0.2	0.33	0.23	N/A	3.77	0.13	0.3	9.68
1990	2,340	0.26	0.38	0.81	0.26	N/A	4.32	0.68	N/A	14.96
1991	3,106	0.35	0.06	0.58	0.19	N/A	4.15	0.06	0.03	9.01
1992	2,520	0.04	0.08	0.75	0.56	N/A	10.79	0.36	0.36	4.09
1993	5,869	N/A	0.15	3.14	0.34	8.62	2.25	N/A	0.12	10.36
1994	4,579	N/A	0.07	3.78	0.31	8.69	1.53	N/A	0.15	8.08
1995	4,392	0.3	0.3	2.44	0.84	2.87	0.34	0.93	0.43	8.06
1996	3,840	0.44	0.73	2.42	1.98	3.78	0.42	0.08	0.26	11.98
1997	5,380	0.69	0.20	1.58	0.22	0.86	0.09	0.11	0.26	8.10
1998	5,169	0.15	0.25	0.00	0.19	0.06	0.21	0.14	0.19	7.70
Hatchery Steelhead										
1985										
1986										
1987										
1988										
1989										
1990	507	0.99	1.18	3.55	1.18	N/A	1.78	N/A	3.16	24.46
1991	1,063	1.03	1.22	1.51	0.38	N/A	0.47	0.09	4.61	25.68
1992	938	0.32	1.71	3.62	0.32	N/A	2.99	N/A	6.08	14.61
1993	2,371	N/A	3.58	5.65	0.89	0.55	1.98	N/A	6.45	36.95
1994	1,812	N/A	1.88	9.93	0.06	0.06	3.92	N/A	15.07	24.17
1995	2,243	4.55	6.55	4.9	7.13	0.13	4.5	0.13	15.07	30.58
1996	2,185	0.87	2.24	4.3	0.64	0.09	0.96	0	9.61	41.05
1997	2,049	1.17	2.54	2.83	0.54	0.05	0.68	0.00	7.22	18.94
1998	1,510	0.73	2.32	0.46	0.40	0.07	1.19	0.13	7.62	12.78
Sockeye										
1985	553	0.18	N/A	0.18	N/A	N/A	N/A	N/A	N/A	9.4
1986	588	1.02	N/A	2.55	N/A	N/A	N/A	N/A	N/A	17.18
1987	740	0.41	N/A	0.81	N/A	N/A	N/A	N/A	N/A	17.3
1988	1,004	0.2	0.4	0.1	N/A	N/A	0.4	N/A	N/A	6.08
1989	1,013	0.59	0.59	0.39	N/A	N/A	0.39	0.2	N/A	10.37
1990	361	N/A	0.28	N/A	N/A	N/A	0.83	N/A	N/A	10.25
1991	549	1.46	0.91	0.18	N/A	N/A	0.18	0.18	0.55	9.47
1992	291	1.03	0.34	0.69	N/A	N/A	N/A	N/A	N/A	12.71
1993	1,765	N/A	1.42	2.1	0.06	N/A	0.45	N/A	0.17	14.84
1994	1,656	N/A	0.48	2.05	N/A	0.06	0.18	N/A	0.54	16
1995	1,103	0.91	1.9	1.18	N/A	N/A	0.27	0.27	1.0	16.41
1996	399	0	1.25	0.25	0.25	0	0.25	0	0.5	20.3
1997	219	0.40	3.20	2.32	1.19	0.00	0.27	0.73	1.59	17.30
1998	1,268	0.08	1.42	0.16	0.00	0.00	0.16	0.08	0.08	15.54

Table C-6. PIT tag detections from John Day Dam, 1993-1998.

Species	Run	Rearing Type	1993 (3B & 3C)	1994 (3B)	1995 (3B)	1996 (3B & 3C)	1997 (3B)	1998 Full Bypass
Chinook	Spring	Hatchery	199	205	267	677	66	8,528
		Wild	23	10	101	37	8	1,242
	Summer	Hatchery	24	16	52	145	57	3,656
		Wild	4		20	40	4	832
		Unknown				1		1
	Fall	Hatchery	4	3	52	187	38	12,174
		Wild	9	4	13	10	2	282
		Unknown						3
	Unknown	Hatchery	44	19	915	795	9	5,964
		Wild	17	4	253	182	1	1,190
		Unknown	15	14	28	215	5	3,340
Chinook Total			339	275	1,701	2,289	190	37,212
Steelhead	Spring	Hatchery				5		
	Summer	Hatchery	195	210	1,068	1,321	663	8,109
		Wild	62	26	115	141	61	2,510
		Unknown				1		10
	Unknown	Hatchery						63
Steelhead Total			257	236	1,183	1,468	724	10,692
Coho	Fall	Hatchery				5	9	652
		Unknown						484
	Spring	Hatchery					3	
Coho Total						5	12	1,136
Sockeye	Spring	Hatchery	17		3			
	Summer	Hatchery				8		186
		Wild		5	1			16
	Unknown	Hatchery				12	1	13
		Wild	19		9	2	1	355
		Unknown						4
Sockeye Total			36	5	13	22	2	574
Unknown	Unknown	Wild						1
Unknown Total								1
TOTALS (all species combined) =			**632**	**516**	**2,897**	**3,784**	**928**	**49,615**

Table C-7. Brand recaptures at John Day Dam, 1985-1998.

Year	Yearling Chinook	Subyearling Chinook	Wild Steelhead	Hatchery Steelhead	Coho	Sockeye	Total
1985	1,960	80	@	2,113	3	334	4,490
1986	6,084	1,927	@	4,324	2	304	12,641
1987	1,890	1,024	@	1,608	4	107	4,633
1988	2,262	1,797	@	895	3	80	5,037
1989	2,207	1,585	@	2,150	1	36	5,979
1990	732	337	@	599	1	9	1,678
1991	576	773	@	1,134		85	2,568
1992*	1,420	945	66	546			2,977
1993*	1,069	1,920	24	1,463		39	4,515
1994	265	830		416			1,511
1995	560	317		183			1,060
1996	255	130		75	2		462
1997				16			16
1998				84			84

@ Brands not differentiated between wild and hatchery steelhead in these years.

* Samples from gatewells 3B and 3C combined.

Table C-8. Adult salmonid fallbacks at John Day Dam, 1985-1998.

	Chinook		Steelhead		Coho	Sockeye	Total
Year	Adults	Jacks	Wild	Hatchery			
1985	28	85	?	50	1	12	176
1986	78	80	?	134	3	4	299
1987	25	4	?	58		1	88
1988	7	2	?	47	2		58
1989	18	7	?	80	1	22	128
1990	14	6	?	35		3	58
1991	10		?	34		6	50
1992	12		?	42	1	4	59
1993	12	2	?	145	1	8	168
1994	5	10	?	52	2	5	74
1995	11	12	40	71	1	2	137
1996	15	9	21	63		7	115
1997*							0
1998^							642

? Fallbacks were not consistently differentiated as wild or hatchery prior to 1995.

* An adult excluder was installed on the sample collection tank in 1997.

^ Species detail was not collected, includes non-salmonids. Sample period: 9-29 to 10-29

Table C-9. Collection numbers for the most numerous incidental species sampled at John Day Dam, 1985 - 1998.

Year	American Shad		Pacific Lamprey		Crappie	Sculpin	Mountain	Sucker	Walleye	S-Mouth	Bluegill[1]	Northern	Peamouth	Chisel-
	Juvenile	Adult	Juvenile	Adult	Species	Species	Whitefish	Species		Bass		Squawfish		mouth
1985[2]	90,904	233	35	15	6,174	675	236	571	161	789	18	89	24	195
1986	49,916	516	890	24	279	201	675	501	308	191	35	250	42	137
1987	18,606	176	229	58	1,016	581	499	372	677	283	22	63	27	86
1988	39,474	312	629	52	293	481	236	178	70	163	16	37	65	27
1989	61,832	451	1,928	7	87	113	269	222	101	74	14	53	108	40
1990[3]	330,177	213	923	4	96	48	253	92	24	60	1,054	17	25	25
1991	168,602	179	9,337	44	99	59	383	162	12	79	159	646	14	16
1992	203,782	175	178	6	38	4,827	444	64	813	119	44	9	32	14
1993	180,088	615	4,348	7	58	256	582	295	133	93	237	56	26	11
1994	111,418	460	3,250	28	28	479	353	234	167	68	8	16	104	25
1995[4]	202,375	772	1,143	36	81	29	294	142	84	115	102	41	200	34
1996	56,245	657	481	10	8	23	303	137	28	38	27	18	28	14
1997	108,961	50	486	3	20	11	79	291	4	16	18	3	6	8
1998	1,281,697	276	149,483	1,012	1,802	2,682	17,725	34,583	628	7,554	4,359	187	310	196

[1] Bluegill and Pumpkinseeds are not differentiated.
[2] Unit 3B was out of service from April 2-26 for STS installations and testing in 1985.
[3] Sampling was done in Gatewell 5B during the 1990 season, and an electrical fire shut down the unit from 29 May to 10 June.
[4] Starting in 1995, subsampling was implemented and collection estimates were calculated. Prior to 1995, all sampling was at 100%.

Table C-10. Summary of sampling effort at John Day Dam, 1985-1998.

					Yearling Chinook					Subyearling Chinook					Coho				
						Collection		Index			Collection		Index			Collection		Index	
Year	Dates	Sampling Effort	Sub-Sampling	Sample Rate	Sample #	Hourly	Daily	Hourly	Daily	Sample #	Hourly	Daily	Hourly	Daily	Sample #	Hourly	Daily	Hourly	Daily
1985	4/27-10/29	24/day	NO	1	63,578	NA	63,578	NA	-	226,577	NA	226,577	NA	-	600	NA	600	NA	-
1986	3/28-10/30	24/day	NO	1	92,591	NA	92,951	NA	-	182,117	NA	182,117	NA	-	1,994	NA	1,994	NA	-
1987	4/1-11/30	24/day	NO	1	84,455	NA	84,455	NA	1,020,768	95,505	NA	95,505	NA	760,605	13,200	NA	13,200	NA	170,353
1988	3/30-10/31	24/day	NO	1	34,045	NA	34,045	NA	408,675	109,448	NA	109,448	NA	363,101	8,650	NA	8,650	NA	109,325
1989	3/28-10/31	24/day	NO	1	34,930	NA	34,930	NA	502,642	129,870	NA	129,870	NA	1,017,342	6,930	NA	6,930	NA	99,811
1990	3/27-10/31	24/day	NO	1	26,992	NA	26,992	NA	361,968	39,602	NA	39,602	NA	513,669	6,261	NA	6,261	NA	84,342
1991	4/7-10/31	24/day	NO	1	26,878	NA	26,878	NA	374,387	46,785	NA	46,785	NA	568,206	5,106	NA	5,106	NA	72,725
1992(3c)**	3/25-10/13	24/day	NO	1	23,052	NA	23,052	NA	NA	27,407	NA	27,407	NA	NA	5,887	NA	5,887	NA	NA
1992(3b)	3/25-10/13	24/day	NO	1	19,179	NA	19,179	-	237,172	32,376	NA	32,376	-	294,861	3,917	NA	3,917	-	48,898
1993(3c)	4/6-10/29	24/day	NO	1	11,054	11,054	11,054	NA	NA	50,243	50,243	50,243	NA	NA	3,437	3,437	3,437	NA	NA
1993(3b)	4/6-10/29	24/day	NO	1	41,767	41,767	41,767	715,853	720,361	66,561	66,561	66,561	671,625	717,434	9,727	9,727	9,727	170,849	173,193
1994	4/5-9/30	24/day	NO	1	34,071	34,199	34,199	455,553	446,854	75,164	121,272	121,272	1,150,694	1,207,368	11,385	11,413	11,413	159,173	151,135
1995	4/6-9/29	24/day	YES	.25-1	34,308	90,704	90,348	1,344,193	1,329,229	48,896	89,790	90,350	1,237,324	1,240,260	5,908	22,341	22,135	343,606	335,902
1996	4/8-9/9	24/day	YES	.25-1	14,560	38,995	38,975	737,815	738,311	31,157	46,238	46,232	747,428	737,841	8,551	27,021	27,043	511,251	504,863
1997	4/8-9/8	24/day	YES	.25-1	4,586	7,646	7,646	148,993	154,026	20,487	24,290	24,333	422,730	448,328	3,409	6,556	6,615	143,291	147,267
1998	4/9-10/31	24/day	YES	.0067-.25	27,732	NA	758,689	NA	1,147,861	31,178	NA	1,584,083	NA	2,155,479	5,330	NA	370,277	NA	572,762

	Wild Steelhead				Hatchery Steelhead				Sockeye				Total				
	Collection		Index			Collection		Index		Collection		Index			Collection		Index	
Sample #	Hourly	Daily	Hourly	Daily	Sample #	Hourly	Daily	Hourly	Daily	Sample #	Hourly	Daily	Hourly	Daily	Sample #	Hourly	Daily	Hourly	Daily
*	NA	*	NA	NA	36,616	NA	36,616	NA	-	17,235	NA	17,235	NA	-	344,606	NA	344,606	NA	-
*	NA	*	NA	NA	37,822	NA	37,822	NA	-	17,505	NA	17,505	NA	-	332,029	NA	332,389	NA	-
*	NA	*	NA	NA	23,988	NA	23,988	NA	300,410	11,911	NA	11,911	NA	145,232	229,059	NA	229,059	NA	2,397,368
*	NA	*	NA	NA	14,985	NA	14,985	NA	179,089	6,333	NA	6,333	NA	80,406	173,461	NA	173,461	NA	1,140,596
*	NA	*	NA	NA	19,818	NA	19,818	NA	281,685	5,496	NA	5,496	NA	78,190	197,044	NA	197,044	NA	1,979,670
5,028	NA	5,028	NA	68,428	4,921	NA	4,921	NA	6,349	1,755	NA	1,755	NA	23,592	84,559	NA	84,559	NA	1,058,348
5,456	NA	5,456	NA	75,687	11,166	NA	11,166	NA	158,305	3,450	NA	3,450	NA	52,203	98,841	NA	98,841	NA	1,301,513
2,770	NA	2,770	NA	NA	6,917	NA	6,917	NA	NA	1,647	NA	1,647	NA	NA	67,680	NA	67,680	NA	NA
2,371	NA	2,371	-	28,712	5,053	NA	5,053	-	63,494	961	NA	961	-	12,051	63,857	NA	63,857	NA	685,188
4,668	4,668	4,668	NA	NA	7,416	7,416	7,416	NA	NA	813	813	813	NA	NA	77,631	77,631	77,631	NA	NA
11,374	11,374	11,374	186,696	189,400	45,520	45,520	45,520	879,844	882,474	14,072	14,072	14,072	267,763	272,869	189,021	189,021	189,021	2,892,630	2,955,731
7,604	7,604	7,604	99,845	96,800	14,454	14,457	14,457	196,281	189,420	7,260	7,270	7,270	101,105	96,621	149,938	196,215	196,215	2,162,651	2,188,198
4,043	11,799	11,584	176,102	170,993	18,915	61,865	61,385	930,405	919,021	5,625	18,982	19,526	287,626	293,065	117,695	295,481	295,328	4,319,256	4,288,470
3,973	11,875	11,903	229,600	228,911	11,171	36,202	36,174	705,551	701,899	1,147	3,367	3,373	64,122	64,584	70,559	163,698	163,700	2,995,767	2,976,409
4,011	7,328	7,337	145,192	151,061	13,645	28,504	28,547	598,959	614,087	738	1,171	1,184	25,441	26,519	46,876	75,495	75,662	1,484,606	1,541,288
8,378	NA	296,969	NA	455,339	6,214	NA	408,195	NA	634,446	4,479	NA	338,099	NA	523,866	83,311	NA	3,756,312	NA	5,489,754

*Wild and hatchery steelhead were not differentiated prior to 1990.

**3C airlift inoperational 5/13-6/18

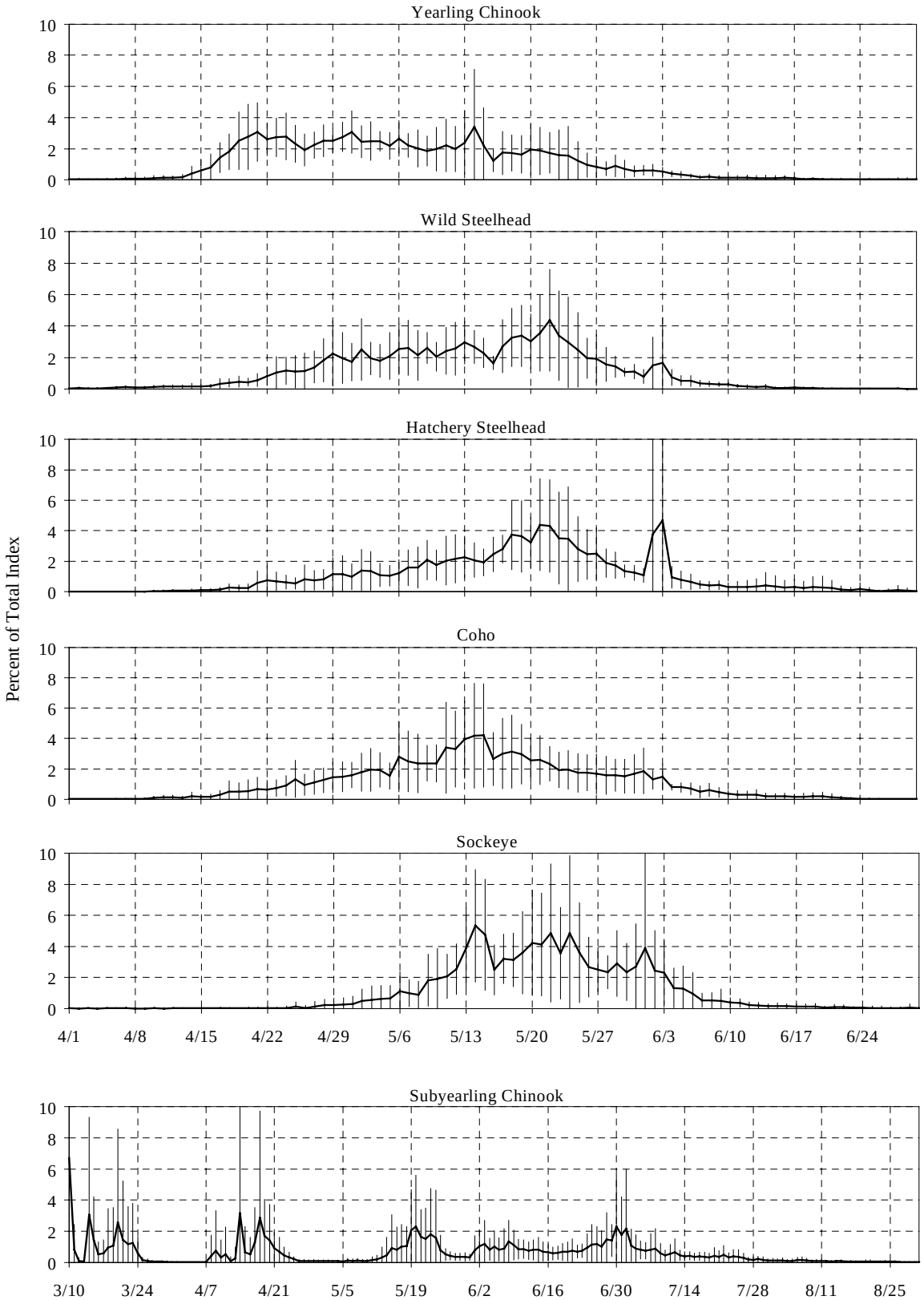

Figure D-1. Historical average passage pattern with standard deviation, Bonneville Dam, 1985 - 1998.

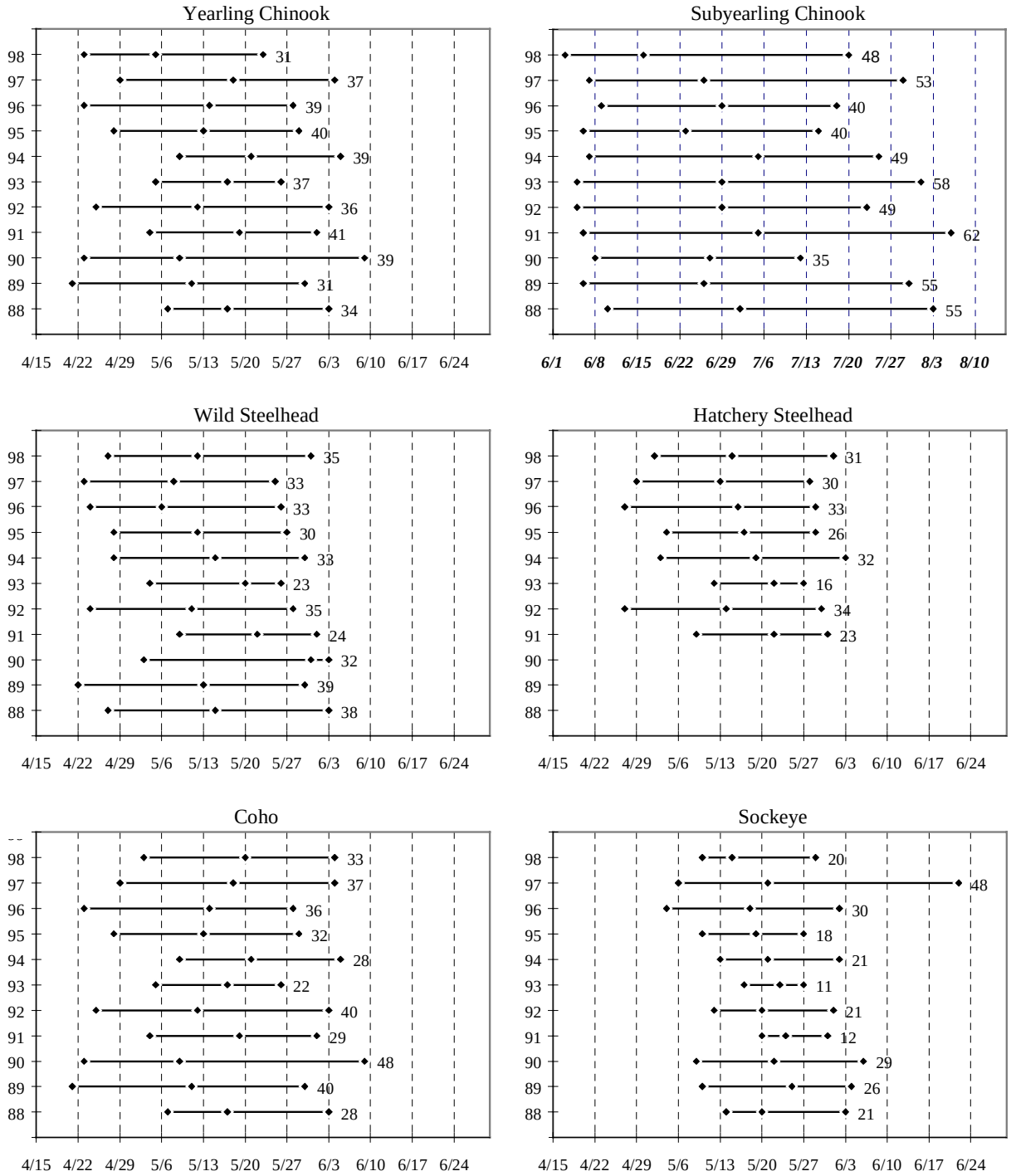

Figure D-2. 10%, 50%, and 90% passage dates for each season at Bonneville Dam, by species, 1988-1998. The duration between 10-90% dates (in days) is indicated for each year. Hatchery and wild steelhead were not differentiated before 1991.

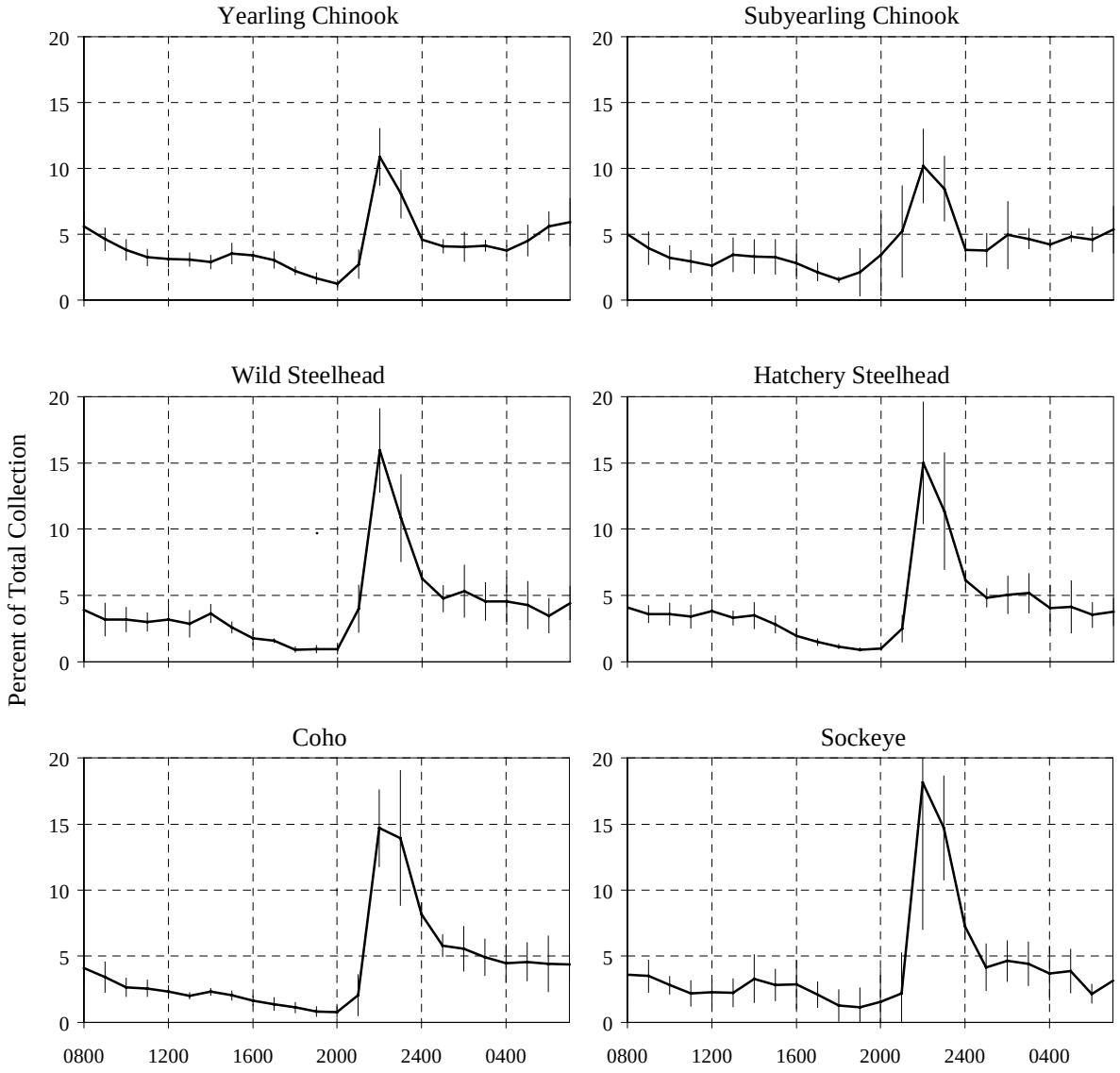

Figure D-3. Historical average diel passage with standard deviation, Bonneville Dam, 1992-1995.

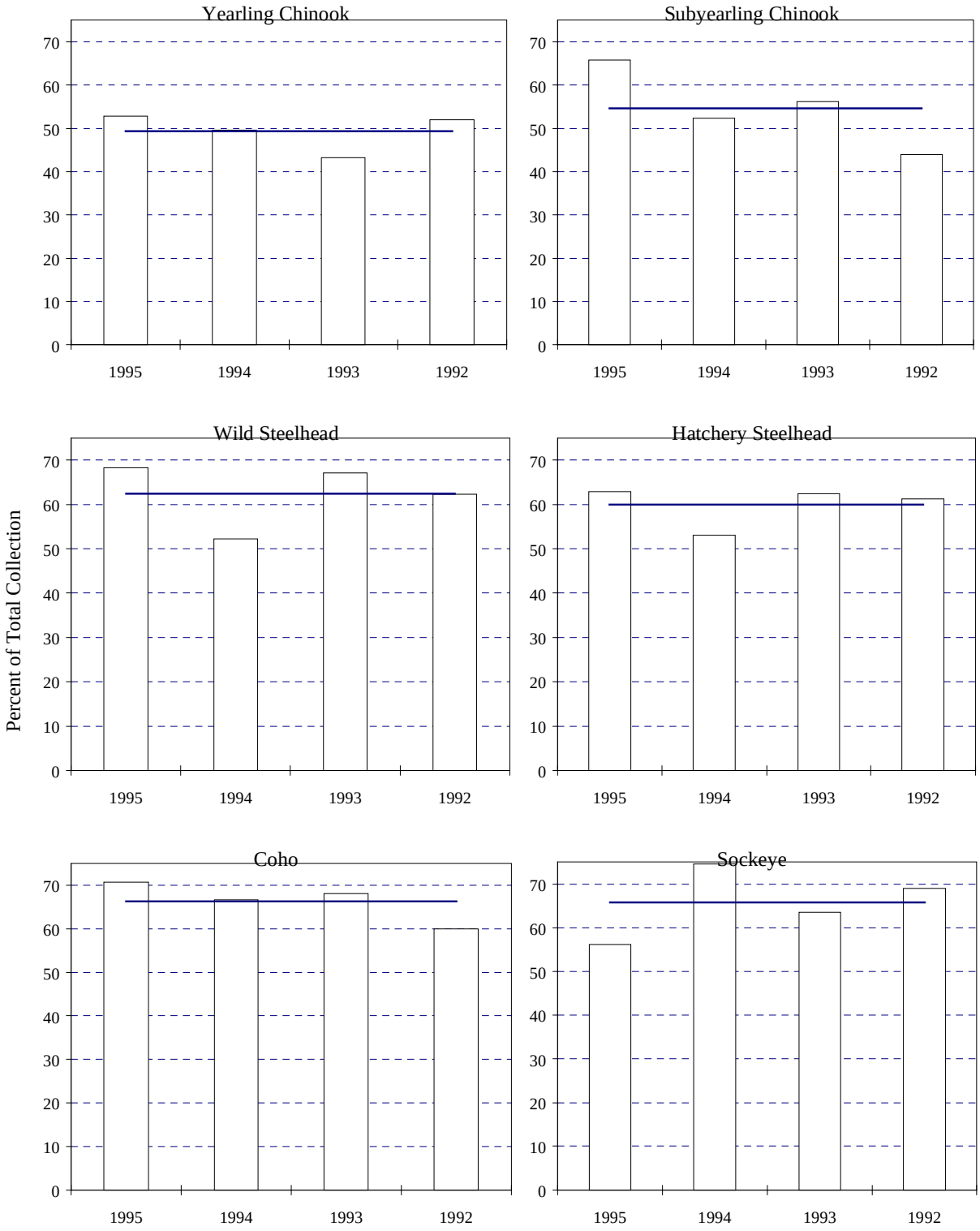

Figure D-4. Percent night passage (2000-0500) for each season of 24 hour monitoring at Bonneville Dam, by species, including the average, 1992-1995.

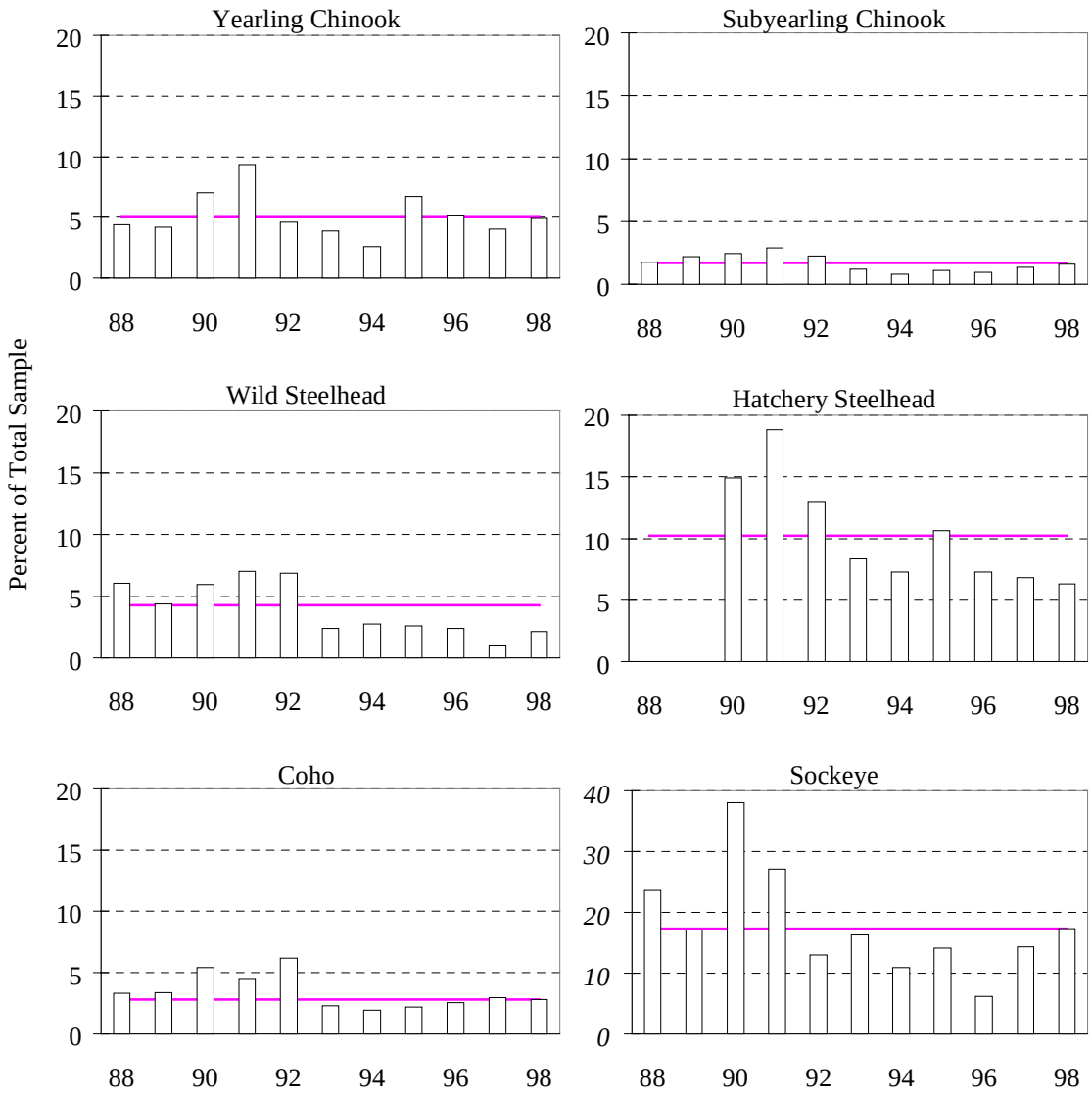

Figure D-5. Historical descaling percentages with the average at Bonneville Dam, PH1, 1988-1998. Hatchery and wild steelhead were not differentiated before 1990.

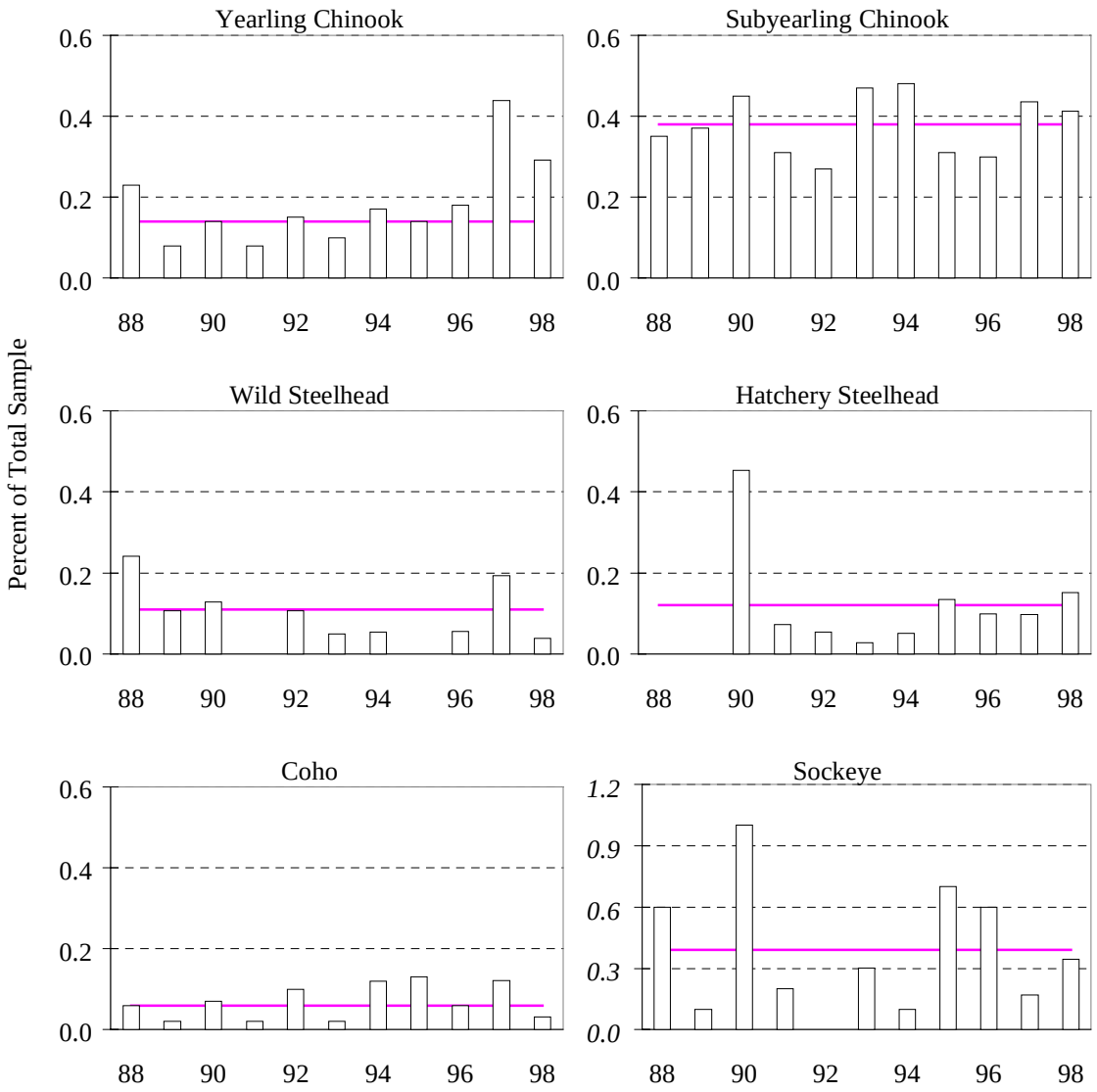

Figure D-6. Historical mortality percentages with the average at Bonneville Dam PH1, 1988-1998. Hatchery and wild steelhead were not differentiated before 1990.

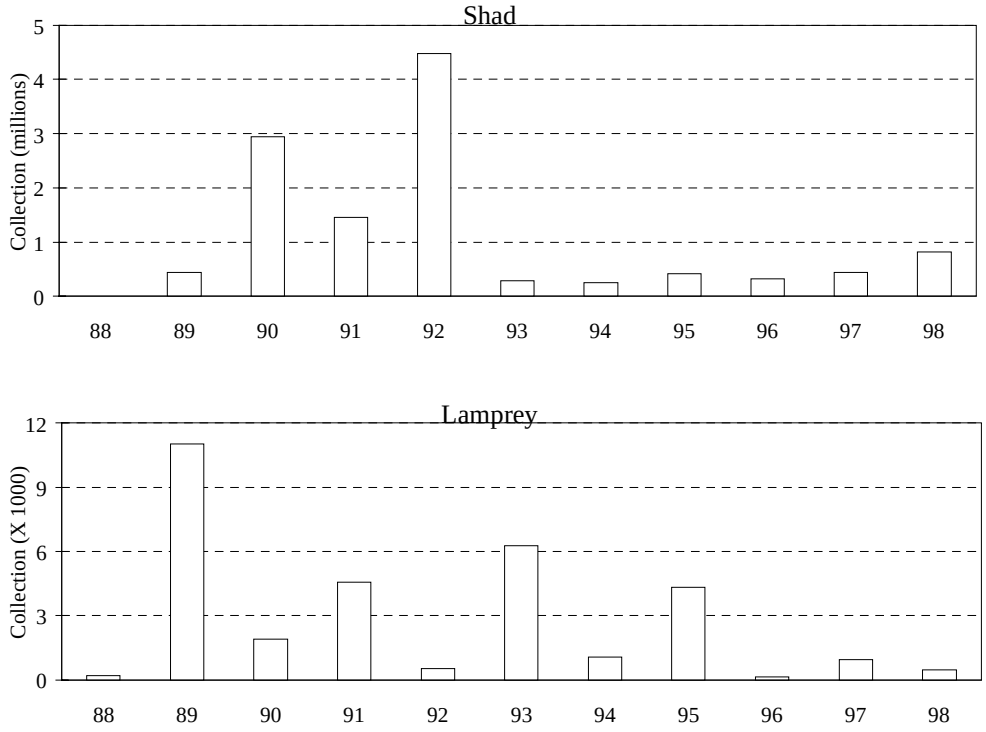

Figure D-7. Historical juvenile shad and lamprey counts at Bonneville Dam, 1988-1998.

Table D-1. Percent night passage (1800-0600) for 1992-95 at Bonneville Dam, PH1.

YEAR	Yearling Chinook	Subyearling Chinook	Wild Steelhead	Hatchery Steelhead	Coho	Sockeye
1995	52.8	65.8	68.3	62.9	70.7	56.2
1994	49.6	52.4	52.2	53.1	66.7	74.6
1993	43.2	56.2	67.1	62.4	68.1	63.6
1992	52.0	44.0	62.3	61.3	60.0	69.0
MEDIAN	50.8	54.3	64.7	61.9	67.4	66.3
MIN	43.2	44.0	52.2	53.1	60.0	56.2
MAX	52.8	65.8	68.3	62.9	70.7	74.6

Table D-2. 10%, 50%, and 90% passage dates at Bonneville Dam, PH1, 1986-1998.

Yearling Chinook				
	10 %	50%	90 %	# of Days
1986*	12-May	22-May	30-May	
1987*	20-Apr	08-May	15-May	
1988	19-Apr	02-May	22-May	34
1989	21-Apr	06-May	21-May	31
1990	17-Apr	03-May	25-May	39
1991	22-Apr	15-May	01-Jun	41
1992	18-Apr	25-Apr	23-May	36
1993	22-Apr	18-May	28-May	37
1994	20-Apr	03-May	28-May	39
1995	17-Apr	09-May	26-May	40
1996	19-Apr	02-May	27-May	39
1997	20-Apr	4-May	26-May	37
1998	23-Apr	5-May	23-May	31
MEDIAN	20-Apr	04-May	26-May	37
MIN	17-Apr	25-Apr	21-May	31
MAX	23-Apr	18-May	01-Jun	41

Subyearling Chinook - "Brights" Only				
	10 %	50%	90 %	# of Days
1986*	02-Jun	06-Jul	29-Oct	
1987*	03-Jun	30-Jun	02-Jul	
1988	10-Jun	02-Jul	03-Aug	55
1989	06-Jun	26-Jun	30-Jul	55
1990	08-Jun	27-Jun	12-Jul	35
1991	06-Jun	05-Jul	06-Aug	62
1992	05-Jun	29-Jun	23-Jul	49
1993	05-Jun	29-Jun	01-Aug	58
1994	07-Jun	05-Jul	25-Jul	49
1995	6-Jun	23-Jun	15-Jul	40
1996	9-Jun	29-Jun	18-Jul	40
1997	7-Jun	26-Jun	29-Jul	53
1998	3-Jun	16-Jun	20-Jul	48
MEDIAN	06-Jun	29-Jun	25-Jul	50
MIN	03-Jun	16-Jun	12-Jul	35
MAX	10-Jun	05-Jul	06-Aug	62

Wild Steelhead				
	10 %	50%	90 %	# of Days
1986*	19-May	27-May	02-Jun	
1987*	01-May	12-May	01-Jun	
1988**	27-Apr	15-May	03-Jun	38
1989**	22-Apr	13-May	30-May	39
1990**	03-May	31-May	03-Jun	32
1991	09-May	22-May	01-Jun	24
1992	24-Apr	11-May	28-May	35
1993	04-May	20-May	26-May	23
1994	28-Apr	15-May	30-May	33
1995	28-Apr	12-May	27-May	30
1996	24-Apr	6-May	26-May	33
1997	23-Apr	8-May	25-May	33
1998	27-Apr	12-May	31-May	35
MEDIAN	27-Apr	12-May	27-May	31
MIN	23-Apr	06-May	25-May	23
MAX	09-May	22-May	01-Jun	35

Hatchery Steelhead				
	10 %	50%	90 %	# of Days
1986*				
1987*				
1988**	ALL STEELHEAD IN WILD			
1989**				
1990**				
1991	09-May	22-May	31-May	23
1992	27-Apr	14-May	30-May	34
1993	12-May	22-May	27-May	16
1994	03-May	19-May	03-Jun	32
1995	04-May	17-May	29-May	26
1996	27-Apr	16-May	29-May	33
1997	29-Apr	13-May	28-May	30
1998	2-May	15-May	1-Jun	31
MEDIAN	02-May	16-May	29-May	28
MIN	27-Apr	13-May	27-May	16
MAX	12-May	22-May	03-Jun	34

Coho				
	10 %	50%	90 %	# of Days
1986*	21-May	28-May	04-Jun	
1987*	06-May	12-May	01-Jun	
1988	07-May	17-May	03-Jun	28
1989	21-Apr	11-May	30-May	40
1990	23-Apr	09-May	09-Jun	48
1991	04-May	19-May	01-Jun	29
1992	25-Apr	12-May	03-Jun	40
1993	05-May	17-May	26-May	22
1994	09-May	21-May	05-Jun	28
1995	28-Apr	13-May	29-May	32
1996	23-Apr	14-May	28-May	36
1997	29-Apr	18-May	4-Jun	37
1998	3-May	20-May	4-Jun	33
MEDIAN	29-Apr	17-May	03-Jun	36
MIN	21-Apr	09-May	26-May	22
MAX	09-May	21-May	09-Jun	48

Sockeye (Wild + Hatchery)				
	10 %	50%	90 %	# of Days
1986*	19-May	28-May	02-Jun	
1987*	13-May	01-Jun	05-Jun	
1988	14-May	20-May	3-Jun	21
1989	10-May	25-May	4-Jun	26
1990	9-May	22-May	6-Jun	29
1991	20-May	24-May	31-May	12
1992	12-May	20-May	1-Jun	21
1993	17-May	23-May	27-May	11
1994	13-May	21-May	2-Jun	21
1995	10-May	19-May	27-May	18
1996	4-May	18-May	2-Jun	30
1997	6-May	21-May	22-Jun	48
1998	10-May	15-May	29-May	20
MEDIAN	10-May	21-May	02-Jun	24
MIN	04-May	15-May	27-May	11
MAX	20-May	25-May	22-Jun	48

* 1986 and 1987 data not included in calculations; the PH1 sampler was operating for testing only.

** Years in which no differentiation was made between wild and hatchery steelhead for index purposes.

Table D-3. Percent of total passage per hour at Bonneville Dam, 1992-1995.

Yearling Chinook

	0800	0900	1000	1100	Noon	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	MID	0100	0200	0300	0400	0500	0600	0700
1992	5.1	5.4	4.1	3.6	3.2	2.9	2.6	2.8	3.1	2.5	1.9	1.4	1.5	3.9	11.8	10.5	4.9	4.2	3.8	4.3	3.6	3.6	5.2	3.8
1993	6.7	5.0	4.8	4.0	4.0	3.4	2.9	4.3	3.8	3.9	2.6	2.2	1.4	1.5	7.9	6.8	3.5	3.5	3.1	3.5	3.4	3.8	6.2	7.7
1994	6.2	4.5	3.2	2.7	2.5	2.4	2.4	2.9	3.2	2.7	2.2	1.6	1.0	2.4	11.0	8.5	4.9	4.1	3.7	4.3	3.8	6.2	6.8	6.9
1995	4.4	3.4	3.1	2.8	2.9	3.6	3.6	4.0	3.4	3.0	2.1	1.4	1.1	3.2	12.9	6.6	5.2	4.7	5.7	4.5	4.3	4.6	4.3	5.1
AVG	5.8	4.5	3.8	3.2	3.1	3.0	2.9	3.6	3.4	3.1	2.3	1.7	1.2	2.5	10.5	7.8	4.5	4.1	4.0	4.1	3.8	4.7	5.8	6.4
MIN	4.4	3.4	3.1	2.7	2.5	2.4	2.4	2.8	3.1	2.5	1.9	1.4	1.0	1.5	7.9	6.6	3.5	3.5	3.1	3.5	3.4	3.6	4.3	3.8
MAX	6.7	5.4	4.8	4.0	4.0	3.6	3.6	4.3	3.8	3.9	2.6	2.2	1.5	3.9	12.9	10.5	5.2	4.7	5.7	4.5	4.3	6.2	6.8	7.7

Subyearling Chinook

	0800	0900	1000	1100	Noon	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	MID	0100	0200	0300	0400	0500	0600	0700
1992	6.5	4.6	4.1	4.0	3.3	5.1	4.4	4.2	4.1	3.0	1.8	1.0	0.6	4.3	9.4	7.9	3.1	2.6	3.1	4.5	4.0	4.5	4.0	5.8
1993	4.5	3.2	2.8	2.3	2.1	2.0	1.9	2.1	1.8	1.6	1.6	4.8	7.7	10.2	7.4	6.1	4.5	5.0	3.8	3.9	4.1	5.0	6.0	5.5
1994	5.8	5.1	3.8	3.2	2.9	3.2	4.2	4.5	3.6	2.2	1.6	0.9	2.0	4.0	9.9	7.7	3.2	2.9	4.3	4.5	4.1	4.7	4.4	7.1
1995	3.2	2.7	2.2	2.4	2.1	3.5	2.6	2.2	1.8	1.7	1.3	1.8	3.5	2.4	14.0	11.9	4.6	4.7	8.7	5.7	4.7	5.2	4.1	3.0
AVG	5.2	4.3	3.4	3.0	2.7	3.3	3.5	3.6	3.0	2.1	1.6	1.8	3.1	5.0	10.1	8.1	3.6	3.5	4.7	4.6	4.2	4.8	4.6	6.0
MIN	3.2	2.7	2.2	2.3	2.1	2.0	1.9	2.1	1.8	1.6	1.3	0.9	0.6	2.4	7.4	6.1	3.1	2.6	3.1	3.9	4.0	4.5	4.0	3.0
MAX	6.5	5.1	4.1	4.0	3.3	5.1	4.4	4.5	4.1	3.0	1.8	4.8	7.7	10.2	14.0	11.9	4.6	5.0	8.7	5.7	4.7	5.2	6.0	7.1

Wild Steelhead

	0800	0900	1000	1100	Noon	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	MID	0100	0200	0300	0400	0500	0600	0700
1992	3.8	3.7	3.2	3.7	3.9	2.6	3.4	2.2	1.1	1.6	0.7	0.7	0.7	4.1	16.9	15.3	6.3	4.1	4.3	4.4	3.2	2.8	3.0	4.2
1993	4.0	2.3	2.4	2.8	2.8	1.9	2.7	2.4	1.8	1.8	1.2	1.0	0.8	2.8	11.9	8.1	6.3	6.2	6.9	6.4	6.7	6.5	5.4	4.9
1994	5.5	4.7	4.4	3.6	4.1	4.4	4.4	3.3	2.4	1.6	1.0	0.8	0.7	2.6	15.5	11.1	5.5	4.1	3.0	2.8	3.0	2.8	3.0	5.5
1995	2.2	2.0	2.6	2.1	2.0	2.7	4.1	2.7	1.9	1.5	0.8	1.3	1.4	6.5	19.4	8.7	6.8	4.3	7.0	4.5	5.3	4.8	2.4	2.8
AVG	4.4	3.4	3.3	3.1	3.3	3.1	3.7	2.8	2.0	1.7	1.0	0.9	0.9	3.3	14.8	10.0	6.0	4.9	5.1	4.5	4.7	4.5	3.8	4.8
MIN	2.2	2.0	2.4	2.1	2.0	1.9	2.7	2.2	1.1	1.5	0.7	0.7	0.7	2.6	11.9	8.1	5.5	4.1	3.0	2.8	3.0	2.8	2.4	2.8
MAX	5.5	4.7	4.4	3.7	4.1	4.4	4.4	3.3	2.4	1.8	1.2	1.3	1.4	6.5	19.4	15.3	6.8	6.2	7.0	6.4	6.7	6.5	5.4	5.5

Hatchery Steelhead

	0800	0900	1000	1100	Noon	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	MID	0100	0200	0300	0400	0500	0600	0700
1992	3.8	3.3	3.2	3.5	4.0	3.3	3.1	2.5	1.3	1.3	1.3	1.1	0.9	3.2	16.5	16.1	6.9	4.3	3.6	3.9	2.7	3.0	3.4	3.6
1993	4.6	3.8	3.3	3.0	4.0	2.6	2.3	2.6	1.9	1.8	1.1	0.9	1.0	1.8	11.0	6.5	5.5	5.7	6.6	7.1	6.4	7.1	4.6	4.6
1994	4.4	4.4	4.7	4.4	3.2	3.5	4.3	3.7	2.6	1.3	1.0	0.9	0.9	1.5	12.1	14.0	6.5	4.4	4.2	4.1	2.8	3.3	3.7	4.3
1995	3.5	2.8	3.1	2.5	4.0	3.9	3.9	2.3	2.0	1.5	1.3	0.8	1.2	3.4	20.8	8.9	5.7	4.8	5.8	5.6	4.1	3.3	2.4	2.4
AVG	4.2	3.7	3.6	3.3	3.8	3.2	3.2	2.8	2.1	1.6	1.1	0.9	1.0	2.2	14.0	9.4	5.8	5.1	5.7	5.9	4.8	5.0	3.8	3.9
MIN	3.5	2.8	3.1	2.5	3.2	2.6	2.3	2.3	1.3	1.3	1.0	0.8	0.9	1.5	11.0	6.5	5.5	4.3	3.6	3.9	2.7	3.0	2.4	2.4
MAX	4.6	4.4	4.7	4.4	4.0	3.9	4.3	3.7	2.6	1.8	1.3	1.1	1.2	3.4	20.8	16.1	6.9	5.7	6.6	7.1	6.4	7.1	4.6	4.6

Coho

	0800	0900	1000	1100	Noon	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	MID	0100	0200	0300	0400	0500	0600	0700
1992	5.5	4.9	3.6	3.4	2.9	2.1	2.2	1.7	1.4	1.4	0.9	0.5	0.4	1.4	14.1	18.5	9.2	4.8	3.5	3.2	2.7	2.7	4.4	4.6
1993	3.5	3.0	2.3	2.1	2.5	1.7	2.2	2.4	2.0	2.0	1.7	1.2	1.1	2.6	11.1	8.1	7.2	6.7	6.4	6.4	6.1	6.1	7.4	4.2
1994	4.6	3.7	2.6	2.1	1.9	2.0	2.1	1.9	1.2	0.8	0.9	0.5	0.4	0.3	15.3	18.1	8.5	5.6	5.1	4.6	4.4	4.7	3.0	5.8
1995	2.7	2.1	2.1	2.5	1.9	2.2	2.6	2.2	1.8	1.4	1.0	1.1	1.1	3.9	18.1	11.2	7.7	6.1	7.4	5.5	4.8	4.8	2.9	2.7
AVG	3.9	3.3	2.5	2.3	2.2	2.0	2.3	2.1	1.6	1.3	1.1	0.8	0.8	1.8	14.5	13.8	8.0	6.0	5.8	5.2	4.8	5.0	4.4	4.6
MIN	2.7	2.1	2.1	2.1	1.9	1.7	2.1	1.7	1.2	0.8	0.9	0.5	0.4	0.3	11.1	8.1	7.2	4.8	3.5	3.2	2.7	2.7	2.9	2.7
MAX	5.5	4.9	3.6	3.4	2.9	2.2	2.6	2.4	2.0	2.0	1.7	1.2	1.1	3.9	18.1	18.5	9.2	6.7	7.4	6.4	6.1	6.1	7.4	5.8

Sockeye

	0800	0900	1000	1100	Noon	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	MID	0100	0200	0300	0400	0500	0600	0700
1992	3.8	5.8	4.5	1.7	2.0	1.8	2.9	1.6	2.6	0.4	0.4	0.1	0.7	0.4	21.0	22.4	11.5	3.7	2.9	2.9	1.8	1.9	0.4	2.9
1993	5.0	2.8	2.9	2.7	2.0	1.8	2.7	2.7	2.2	2.2	1.7	1.6	1.9	2.9	17.0	5.1	4.7	5.4	7.0	6.1	5.5	5.7	4.3	3.9
1994	3.4	3.6	1.9	1.6	1.3	1.3	2.5	1.6	2.1	1.1	0.5	0.3	0.1	0.1	20.2	26.1	9.8	4.5	4.1	3.4	3.0	2.4	1.6	3.6
1995	1.7	1.6	2.1	2.8	3.5	3.9	4.9	5.4	4.7	4.6	2.5	2.7	3.4	5.4	14.4	5.2	3.3	3.1	4.8	5.3	4.7	5.6	2.3	2.2
AVG	3.9	2.8	2.5	2.5	2.1	2.1	3.1	2.9	2.7	2.4	1.6	1.5	1.7	2.7	17.3	10.6	5.8	4.7	5.8	5.2	4.7	4.8	3.2	3.5
MIN	1.7	1.6	1.9	1.6	1.3	1.3	2.5	1.6	2.1	0.4	0.4	0.1	0.1	0.1	14.4	5.1	3.3	3.1	2.9	2.9	1.8	1.9	0.4	2.2
MAX	5.0	5.8	4.5	2.8	3.5	3.9	4.9	5.4	4.7	4.6	2.5	2.7	3.4	5.4	21.0	26.1	11.5	5.4	7.0	6.1	5.5	5.7	4.3	3.9

All species combined

	0800	0900	1000	1100	Noon	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	MID	0100	0200	0300	0400	0500	0600	0700
1992	6.0	4.8	4.0	3.8	3.2	4.2	3.7	3.6	3.5	2.7	1.7	1.0	0.8	3.9	10.6	9.8	4.3	3.2	3.3	4.3	3.7	4.1	4.3	5.2
1993	4.9	3.6	3.3	2.8	2.8	2.3	2.3	2.8	2.4	2.3	1.8	3.0	4.1	5.6	9.1	6.6	4.8	5.0	4.5	4.6	4.6	5.1	6.1	5.7
1994	5.7	4.8	3.6	3.0	2.7	2.9	3.7	3.8	3.2	2.1	1.6	0.9	1.5	3.2	11.1	9.7	4.3	3.5	4.3	4.5	4.0	4.8	4.5	6.8
1995	3.3	2.7	2.5	2.5	2.4	3.3	3.0	2.8	2.3	2.1	1.5	1.6	2.4	3.0	14.8	10.0	5.3	4.9	7.4	5.3	4.6	4.9	3.8	3.4
AVG	5.1	4.1	3.3	2.9	2.7	3.0	3.2	3.3	2.9	2.2	1.6	1.6	2.3	3.8	11.2	9.0	4.6	4.1	4.8	4.7	4.2	4.8	4.7	5.7
MIN	3.3	2.7	2.5	2.5	2.4	2.3	2.3	2.8	2.3	2.1	1.5	0.9	0.8	3.0	9.1	6.6	4.3	3.2	3.3	4.3	3.7	4.1	3.8	3.4
MAX	6.0	4.8	4.0	3.8	3.2	4.2	3.7	3.8	3.5	2.7	1.8	3.0	4.1	5.6	14.8	10.0	5.3	5.0	7.4	5.3	4.6	5.1	6.1	6.8

Table D-4. Descaling and mortality data from Bonneville Dam, PH1, 1988 - 1998.

	YEARLING CHINOOK					SUBYEARLING CHINOOK				
YEAR	SAMPLE	DESC	%DESC	MORT	%MORT	SAMPLE	DESC	%DESC	MORT	%MORT
1988	28,958	1,265	4.4	67	0.2	96,415	1,659	1.7	337	0.4
1989	27,934	1,164	4.2	22	0.1	98,571	2,119	2.2	361	0.4
1990	23,821	1,675	7.0	34	0.1	80,446	1,956	2.4	358	0.5
1991	29,409	2,741	9.3	24	0.1	83,240	2,383	2.9	257	0.3
1992	42,523	1,952	4.6	62	0.2	112,037	2,517	2.3	301	0.3
1993	52,623	2,050	3.9	51	0.1	130,615	1,557	1.2	611	0.5
1994	34,361	896	2.6	58	0.2	125,967	999	0.8	600	0.5
1995	19,557	1,310	6.7	27	0.1	60,356	651	1.1	189	0.3
1996	7,246	370	5.1	13	0.2	27,113	254	0.9	82	0.3
1997	5,938	239	4.0	26	0.4	44,024	595	1.4	192	0.4
1998	6,850	337	4.9	20	0.3	30,835	485	1.6	127	0.4
TOTAL	279,220	13,999	5.0	404	0.1	889,619	15,175	1.7	3,415	0.4

	WILD STEELHEAD					HATCHERY STEELHEAD				
YEAR	SAMPLE	DESC	%DESC	MORT	%MORT	SAMPLE	DESC	%DESC	MORT	%MORT
1988*	7,478	452	6.1	18	0.2					
1989*	12,240	536	4.4	13	0.1					
1990	3,894	232	6.0	5	0.1	5,521	818	14.9	25	0.5
1991	2,772	194	7.0	0	0.0	5,502	1,036	18.8	4	0.1
1992	2,837	194	6.8	3	0.1	3,767	487	12.9	2	0.1
1993	4,025	96	2.4	2	0.0	7,456	622	8.3	2	0.0
1994	3,730	102	2.7	2	0.1	3,981	290	7.3	2	0.1
1995	1,240	32	2.6	0	0.0	3,737	397	10.6	5	0.1
1996	1,821	44	2.4	1	0.1	5,075	369	7.3	5	0.1
1997	3,615	35	1.0	7	0.2	9,285	635	6.8	9	0.1
1998	2,587	56	2.2	1	0.0	3,294	208	6.3	5	0.2
TOTAL	46,239	1,973	4.3	52	0.1	47,618	4,862	10.2	59	0.1

	COHO					SOCKEYE				
DATE	SAMPLE	DESC	%DESC	MORT	%MORT	SAMPLE	DESC	%DESC	MORT	%MORT
1988	40,776	1,340	3.3	24	0.1	4,588	1,077	23.6	28	0.6
1989	29,747	998	3.4	5	0.0	7,723	1,319	17.1	11	0.1
1990	43,032	2,325	5.4	30	0.1	4,537	1,710	38.1	45	1.0
1991	23,842	1,059	4.4	5	0.0	4,462	1,205	27.1	9	0.2
1992	23,971	1,485	6.2	24	0.1	638	83	13.0	0	0.0
1993	28,243	649	2.3	6	0.0	4,939	803	16.3	15	0.3
1994	22,378	430	1.9	27	0.1	2,965	322	10.9	2	0.1
1995	11,868	258	2.2	16	0.1	2,184	305	14.1	15	0.7
1996	12,689	320	2.5	8	0.1	694	43	6.2	4	0.6
1997	12,346	363	2.9	15	0.1	589	84	14.3	1	0.2
1998	6,272	176	2.8	2	0.0	1,737	299	17.3	6	0.3
TOTAL	255,164	9,403	3.7	162	0.1	35,056	7,250	20.8	136	0.4

* Wild and hatchery steelhead numbers are combined for 1988-89.

Table D-5. Descaling and mortality data from Bonneville Dam, PH2, 1988-1998.

	YEARLING CHINOOK					SUBYEARLING CHINOOK				
YEAR	SAMPLE	DESC	%DESC	MORT	%MORT	SAMPLE	DESC	%DESC	MORT	%MORT
1988	7,076	361	5.2	147	2.1	9,711	185	2.0	390	4.0
1989	15,579	671	4.4	478	3.1	12,144	74	0.6	176	1.5
1990	5,267	278	5.3	36	0.7	2,669	8	0.3	10	0.4
1991	17,943	1,780	10.0	143	0.8	7,846	140	1.8	39	0.5
1992	358	36	10.2	5	1.4	1,452	42	2.9	6	0.4
1993	5,468	393	7.2	36	0.7	5,545	65	1.2	36	0.7
1994	4,172	208	5.1	54	1.3	5,703	80	1.4	138	2.4
1995	2,709	180	6.7	16	0.6	4,696	108	2.3	31	0.7
1996	3,059	304	10.0	16	0.5	8,662	176	2.0	29	0.3
1997	1,311	72	5.5	2	0.2	7,415	138	1.9	52	0.7
1998	3,355	146	4.4	9	0.3	5,519	57	1.0	24	0.4
TOTAL	66,297	4,429	6.8	942	1.4	71,362	1,073	1.5	931	1.3

	WILD STEELHEAD					HATCHERY STEELHEAD				
YEAR	SAMPLE	DESC	%DESC	MORT	%MORT	SAMPLE	DESC	%DESC	MORT	%MORT
1988*	762	43	5.7	12	1.6					
1989*	2,049	84	4.2	31	1.5					
1990	206	5	2.5	4	1.9	176	25	15.6	16	9.1
1991	921	88	9.6	6	0.7	1,614	321	20.1	17	1.1
1992	3	0	0.0	0	0.0	4	0	0.0	0	0.0
1993	255	16	6.3	0	0.0	462	79	17.1	1	0.2
1994	279	31	11.2	1	0.4	218	5	2.3	2	0.9
1995	65	4	6.3	1	1.5	184	35	19.1	1	0.5
1996	182	1	0.6	1	0.5	531	48	9.1	1	0.2
1997	461	14	3.0	0	0.0	1,596	134	8.4	3	0.2
1998	695	23	3.3	2	0.3	720	38	5.3	2	0.3
TOTAL	5,878	309	5.3	58	1.0	5,505	685	12.5	43	0.8

	COHO					SOCKEYE				
YEAR	SAMPLE	DESC	%DESC	MORT	%MORT	SAMPLE	DESC	%DESC	MORT	%MORT
1988	5,556	195	3.6	61	1.1	237	33	16.4	36	15.2
1989	9,192	282	3.1	207	2.3	2,247	343	19.1	451	20.1
1990	5,498	204	3.7	16	0.3	137	25	18.5	2	1.5
1991	7,284	448	6.2	33	0.5	2,575	761	30.3	61	2.4
1992	119	9	7.6	1	0.8	1	1	100.0	0	0.0
1993	3,621	162	4.5	7	0.2	623	126	20.4	4	0.6
1994	2,678	69	2.6	18	0.7	400	75	18.9	4	1.0
1995	1,075	29	2.7	5	0.5	348	61	18.0	9	2.6
1996	4,296	113	2.6	18	0.4	196	33	17.2	4	2.0
1997	2,169	54	2.5	6	0.3	520	118	23.0	6	1.2
1998	1,303	75	5.8	9	0.7	711	80	11.3	0	0.0
TOTAL	42,791	1,640	3.9	381	0.9	7,995	1,656	22.3	577	7.2

* Wild and hatchery steelhead numbers are combined for 1988-89.

Table D-6. Condition subsampling data, expressed as a percent of total, from Bonneville Dam, PH1, 1988-1998.

YEAR	NO.	INJURY			DISEASE				BIRD	3-19%
	SMPLD	HEAD	OPERC.	BODY	PAR.	COL.	FUN.	BKD	PRED	DESC
Yearling Chinook										
1988	1856	0.27	0.05	0.59	0.05	N/A	0.11	0.00	0.16	4.20
1989	2327	0.39	0.39	1.12	0.21	N/A	0.34	0.17	0.43	8.04
1990	3111	0.10	0.13	0.84	0.13	N/A	0.51	0.23	0.58	9.64
1991	2158	0.42	0.32	0.65	0.00	N/A	0.23	0.23	0.42	5.38
1992	2190	0.41	0.23	0.73	0.27	N/A	0.37	0.87	0.50	6.39
1993	2934	0.00	0.65	3.03	0.55	N/A	0.85	0.00	0.55	14.25
1994	4018	0.00	0.37	1.84	0.20	N/A	0.77	0.00	1.14	9.98
1995	2648	1.44	1.36	4.80	0.98	N/A	0.87	1.13	0.98	14.31
1996	2305	0.52	0.56	1.52	0.22	0.00	0.48	0.43	1.13	12.75
1997	1591	0.19	0.44	1.19	0.06	0.00	0.31	0.13	0.94	9.99
1998	1687	0.41	0.24	0.65	0.18	0.00	1.01	0.24	0.95	13.04
Subyearling Chinook										
1988	3451	0.09	0.03	0.67	0.03	N/A	0.09	0.00	0.12	2.98
1989	8481	0.15	0.09	1.29	0.15	N/A	0.05	0.12	0.04	4.55
1990	6929	0.10	0.14	0.64	0.16	N/A	0.07	0.32	0.27	1.93
1991	4404	0.23	0.11	0.43	0.30	N/A	0.05	0.52	0.09	2.45
1992	4422	0.09	0.25	0.34	0.41	N/A	0.05	0.79	0.47	3.55
1993	8343	0.00	0.36	3.12	0.31	N/A	0.08	0.00	0.11	7.76
1994	7149	0.00	0.29	0.92	0.10	N/A	0.10	0.00	0.08	4.00
1995	5230	0.33	0.44	1.97	0.23	N/A	0.13	0.17	0.13	5.35
1996	4080	0.32	0.47	0.69	0.12	0.00	0.17	0.05	0.22	4.56
1997	4893	0.25	0.49	0.76	0.25	0.02	0.16	0.14	0.16	5.89
1998	3324	0.33	0.48	1.08	0.30	0.00	0.39	0.15	0.21	8.33
Wild Steelhead										
1988	2148	0.09	0.05	0.28	0.05	N/A	0.61	0.00	0.05	3.17
1989	2626	0.42	0.23	0.42	0.19	N/A	0.30	0.00	0.19	6.28
1990	3468	0.09	0.09	0.43	0.09	N/A	0.40	0.06	0.46	7.73
1991	1967	0.20	0.20	0.36	0.20	N/A	0.15	0.10	0.31	1.83
1992	1883	0.27	0.37	0.32	0.16	N/A	0.64	0.00	0.32	5.47
1993	2227	0.00	0.45	1.93	0.27	N/A	0.90	0.00	0.31	5.34
1994	2725	0.00	0.22	1.10	0.11	N/A	1.10	0.00	0.33	6.68
1995	2574	0.62	0.35	3.11	0.85	N/A	1.09	0.12	0.47	7.58
1996	2720	0.18	0.18	0.55	0.18	0.11	0.37	0.04	1.03	10.22
1997	2347	0.30	0.09	0.60	0.09	0.00	0.30	0.04	0.55	7.93
1998	768	0.65	0.52	0.91	4.56	0.00	0.39	0.00	1.95	10.94
Hatchery Steelhead										
1988										
1989										
1990	1042	0.38	0.19	1.44	4.03	N/A	1.25	0.00	2.11	10.08
1991	706	0.85	0.71	1.56	8.22	N/A	0.71	0.00	1.56	2.55
1992	590	0.17	0.17	0.68	5.59	N/A	0.34	0.00	2.20	5.59
1993	1250	0.00	0.24	1.60	6.64	N/A	0.72	0.00	5.84	6.56
1994	1429	0.00	0.49	2.59	8.33	N/A	0.49	0.00	2.80	9.24
1995	419	1.67	1.19	2.86	19.33	N/A	0.24	0.00	3.10	9.79
1996	789	0.25	0.63	0.38	8.11	0.00	0.25	0.00	1.52	9.00
1997	1306	0.61	0.77	1.23	4.59	0.00	0.23	0.00	2.07	6.89
1998	1011	0.69	2.77	2.08	0.30	0.00	1.58	0.00	7.52	25.32
Coho										
1988	1403	0.78	0.29	0.78	1.50	0.50	0.00	0.00	3.85	7.48
1989	2319	0.43	0.73	1.21	3.32	N/A	1.03	0.04	2.50	10.48
1990	1366	0.88	0.73	1.46	0.15	N/A	3.07	0.00	6.15	21.52
1991	1024	0.29	4.39	0.88	0.20	N/A	0.78	0.20	3.81	9.67
1992	735	0.41	2.99	1.09	0.41	N/A	1.22	0.00	4.76	11.02
1993	1669	0.00	1.86	3.18	2.22	N/A	1.44	0.00	0.00	16.12
1994	1595	0.00	3.13	3.64	0.94	N/A	0.56	0.00	8.40	21.63
1995	1278	1.88	3.36	5.71	2.11	N/A	3.05	0.08	8.29	25.67
1996	1789	0.28	3.47	2.12	0.11	0.00	0.78	0.06	10.01	27.56
1997	1978	0.01	0.03	0.02	0.05	0.15	0.40	0.00	6.77	25.28
1998	1960	0.41	0.31	0.36	0.15	0.00	1.12	0.05	0.36	7.60
Sockeye										
1988	686	0.00	0.00	0.00	0.00	N/A	0.00	0.00	0.00	9.62
1989	1397	0.50	0.50	0.36	0.00	N/A	0.07	0.07	0.07	16.11
1990	1425	1.26	0.77	0.49	0.07	N/A	0.14	0.07	0.14	14.88
1991	621	0.97	2.25	0.81	0.00	N/A	0.32	0.00	0.32	11.27
1992	131	0.76	2.29	0.76	0.00	N/A	0.00	0.00	0.00	17.56
1993	940	0.11	2.34	3.09	0.32	N/A	0.43	0.00	0.21	23.83
1994	1047	0.00	1.91	1.43	0.00	N/A	0.29	0.00	0.19	26.65
1995	829	0.97	2.41	1.09	0.00	N/A	0.72	0.00	0.24	23.88
1996	307	0.00	1.30	1.63	0.33	0.00	0.00	0.00	0.00	13.36
1997	215	1.40	2.79	0.47	0.00	0.00	0.00	0.00	0.00	25.58
1998	595	2.02	2.86	0.34	0.00	0.00	1.18	0.00	0.00	26.55

Table D-7. Numbers of PIT tagged fish detected at Bonneville Dam, 1992-1998.

Species	Run	Rearing Type	1992	1993	1994	1995	1996*	1997^	1998
Chinook	Spring	Hatchery	1	70	48	38	831	2,323	7,563
		Wild	1	13	5	13	60	127	832
		Unknown	4						
	Summer	Hatchery		6	6	9	273	1,199	2,364
		Wild		1	2	5	43	75	604
		Unknown							1
	Fall	Hatchery		1		20	140	1,608	5,024
		Wild		2	3	2	2	117	79
		Unknown	2					7,127	3,891
	Unknown	Hatchery	4	15	7	131	1,057	161	5,018
		Wild		6	2	60	180	2	1,033
		Unknown	5	9	4	2	223	78	1,883
Chinook Total			17	123	77	280	2,809	12,817	28,292
Steelhead	Spring	Hatchery					18		
	Summer	Hatchery		16	19	46	1,454	7,242	4,747
		Wild		5	4	3	200	423	1,482
		Unknown		1			2	8	5
	Unknown	Hatchery							9
Steelhead Total			0	22	23	49	1,674	7,673	6,243
Coho	Spring	Hatchery						102	
	Summer	Unknown							1
	Fall	Hatchery					13	76	269
		Unknown							68
	Unknown	Hatchery							117
		Unknown						4,789	7,796
Coho Total							13	4,967	8,251
Sockeye	Spring	Hatchery		6					
	Summer	Hatchery					11	5	161
		Wild					2	1	12
	Unknown	Hatchery	2		1		23	11	12
		Wild		4	4	1	16	33	158
		Unknown							2
Sockeye Total			2	10	5	1	52	50	345
TOTALS (all detections combined) =			**25**	**155**	**105**	**330**	**4,548**	**25,507**	**43,131**

* PH1 flat plate detections added.

^ PH2 full bypass detections added.

Table D-8. Brand recaptures at Bonneville Dam, 1988-1998.

Year	Yearling Chinook	Subyearling Chinook	Wild Steelhead	Hatchery Steelhead	Coho	Sockeye	Total
1988	425	165	@	157	2	55	804
1989	521	364	@	443		16	1,344
1990	286	189	@	218		6	699
1991	258	235	@	204	2	48	747
1992	220	212	18	40			490
1993	349	360	6	57		19	791
1994	55	187		27			269
1995	181	147		77			405
1996*	91	56		63	1		211
1997*				32			32
1998*				8			8

@ Brands not differentiated between wild and hatchery steelhead in these years.

* Includes data from PH1 and PH2.

Table D-9. Adult salmonid fallbacks captured at PH1, Bonneville Dam, 1988-1998.

Year	Chinook	Steelhead	Coho	Sockeye	Total
1988	1	1			2
1989	4	1	1	1	7
1990	1				1
1991	3	5		7	15
1992	1				1
1993	4				4
1994	2	1			3
1995	1	6			7
1996	1	3		1	5
1997		1		1	2
1998					0

Table D-10. Collection numbers for the most numerous incidental species sampled at PH1, Bonneville Dam, 1988 - 1998.

Year	American Shad		Pacific Lamprey		Stickleback	Peamouth	Northern Squawfish	Redside Shiner	S-Mouth Bass	Sculpin Species	Mountain Whitefish
	Juvenile	Adult	Juvenile	Adult							
1988	2,361	17	204	37	1,017	754	243	264	228	177	33
1989	435,653	39	34,756	63	2,473	1,413	698	384	5	193	34
1990	2,939,363	0	1,909	0	4,527	224	520	56	88	47	58
1991	1,454,524	8	4,567	4	1,862	849	889	224	31	12	121
1992	4,479,820	46	531	86	6,581	1,053	672	67	162	136	41
1993	288,463	148	6,269	78	6,583	1,603	264	377	251	268	75
1994	252,474	85	1,074	47	78,799	4,669	311	269	122	56	65
1995	414,487	1,130	4,335	213	5,931	2,227	979	677	567	233	665
1996	318,190	104	146	60	88	823	21	259	59	60	73
1997	437,715	1,097	945	48	175	1,175	50	128	805	87	113
1998	820,864	64	464	26	81	899	124	39	52	4	84

Note: All values are based on 8 hour samples except for the years 1992-1995, which are based on 24 hour sample numbers.

Table D-11. Sample and collection numbers of chinook and coho fry at Bonneville Dam, PH1, 1992-1998.

YEAR	# of sample hours/day	Chinook Sampled	Chinook Collected	Coho Sampled	Coho Collected
1992	24	2,742	15,165		
1993	24	5,659	61,457		
1994	24	1,538	14,731	72	459
1995	24	1,917	30,440	156	1,389
1996	8	79	647	9	97
1997	8	459	3,761	13	105
1998	8	510	8,116	28	452

Table D-12. Summary of smolt monitoring at Bonneville Dam, PH1, 1986-1998.

					Yearling Chinook					**Subyearling Chinook**					**Coho**				
						Collection		Index			Collection		Index			Collection		Index	
Year	Dates	Sampling Effort	Sub-Sampling	Sample Rate	Sample #	Hourly	Daily	Hourly	Daily	Sample #	Hourly	Daily	Hourly	Daily	Sample #	Hourly	Daily	Hourly	Daily
1986	5/12-11/26	8hr, 5 d/wk	YES	-	9,495	NA	48,282	NA	NA	23,252	NA	86,220	NA	NA	11,538	NA	54,181	NA	NA
1987	3/13-11/20	8hr, 5 d/wk	YES	-	28,828	NA	120,108	NA	NA	61,925	NA	371,000	NA	NA	23,188	NA	102,228	NA	NA
1988	3/15-11/30	8hr/day	YES	-	26,955	NA	301,479	NA	365,812	96,413	NA	580,644	NA	724,102	40,750	NA	419,286	NA	599,194
1989	3/15-11/30	8hr/day	YES	.1-.25	27,935	NA	223,134	NA	435,455	98,521	NA	1,332,736	NA	1,756,794	29,746	NA	257,244	NA	491,618
1990	3/12-11/30	8hr/day	YES	1.67-.2	23,843	NA	196,216	NA	332,792	80,422	NA	658,702	NA	1,219,778	43,030	NA	365,826	NA	677,413
1991	3/15-11/30	8hr/day	YES	1.67-.2	29,374	NA	242,016	NA	609,411	83,189	NA	604,368	NA	1,257,388	23,842	NA	216,330	NA	575,098
1992	3/13-11/20	24hr/day	YES	1.67-.2	42,523	286,037	284,983	799,800	723,655	112,037	882,708	882,211	2,433,053	2,320,423	23,971	139,132	140,403	471,205	388,809
1993	3/17-11/24	24hr/day	YES	1.67-.2	52,623	707,748	715,905	2,255,149	2,168,019	130,615	1,190,261	1,181,615	4,872,526	4,339,394	28,243	421,432	392,627	1,596,578	1,250,698
1994	3/10-10/31	24hr/day	YES	1.67-.2	34,362	242,624	248,741	789,593	779,713	125,967	1,361,893	1,360,832	3,810,943	3,607,383	22,378	205,520	201,310	699,119	626,443
1995	3/11-10/31	24hr/day	YES	1.67-.2	19,557	496,882	500,804	1,784,311	1,776,344	60,356	1,001,033	994,015	3,936,028	3,406,412	11,868	303,527	301,950	1,159,892	1,104,471
1996	3/11-10/31	8hr/day	YES	1.67-.2	7,825	NA	77,780	NA	360,961	29,556	NA	432,364	NA	1,593,073	13,076	NA	156,957	NA	675,605
1997	3/17-10/30	8hr/day	YES	1.67-.2	5,938	NA	56,891	NA	286,666	44,024	NA	342,192	NA	1,501,962	12,346	NA	128,031	NA	706,780
1998	3/9-10/31	8hr/day	YES	.0833-.25	6,850	NA	97,581	NA	346,281	30,835	NA	450,650	NA	1,591,883	6,272	NA	121,695	NA	513,643

Wild Steelhead					**Hatchery Steelhead**					**Sockeye**					**Total**				
	Collection		Index			Collection		Index			Collection		Index			Collection		Index	
Sample #	Hourly	Daily	Hourly	Daily	Sample #	Hourly	Daily	Hourly	Daily	Sample #	Hourly	Daily	Hourly	Daily	Sample #	Hourly	Daily	Hourly	Daily
*	NA	*	NA	NA	3,753	NA	19,181	NA	NA	2,883	NA	14,350	NA	NA	50,921	NA	222,214	NA	NA
*	NA	*	NA	NA	8,760	NA	38,306	NA	NA	4,079	NA	18,733	NA	NA	126,780	NA	650,375	NA	NA
*	NA	*	NA	*	7,473	NA	75,662	NA	103,701	4,587	NA	52,023	NA	77,921	176,178	NA	1,429,094	NA	1,870,730
*	NA	*	NA	*	12,240	NA	106,787	NA	206,226	7,723	NA	72,962	NA	138,310	176,165	NA	1,992,863	NA	3,028,403
3,894	NA	36,812	NA	62,826	5,525	NA	64,400	NA	65,056	4,537	NA	42,633	NA	81,403	161,251	NA	1,364,589	NA	2,439,268
2,775	NA	26,295	NA	74,438	5,504	NA	54,528	NA	155,754	4,462	NA	47,722	NA	147,174	149,146	NA	1,191,259	NA	2,819,263
2,837	16,478	16,503	60,823	46,098	3,767	21,823	21,915	81,871	62,486	638	3,709	3,872	13,196	10,835	185,773	1,349,887	1,349,887	3,859,948	3,552,306
4,025	77,143	74,138	258,236	226,120	7,456	190,608	185,240	618,692	563,884	4,939	184,129	178,245	575,586	538,837	227,901	2,771,321	2,727,770	10,176,767	9,086,952
3,730	29,422	29,796	99,490	93,520	3,981	33,233	33,827	112,506	105,693	2,965	29,845	27,945	106,584	87,146	193,383	1,902,537	1,902,451	5,618,235	5,299,898
1,240	30,225	29,963	111,694	106,889	3,737	102,933	103,508	394,457	376,571	2,184	67,625	71,990	256,946	263,680	98,942	2,002,225	2,002,230	7,643,328	7,034,367
1,885	NA	22,787	NA	101,655	5,083	NA	58,825	NA	254,448	703	NA	7,239	NA	28,513	58,128	NA	755,952	NA	3,014,255
3,615	NA	38,829	NA	205,873	9,285	NA	105,516	NA	575,077	589	NA	5,765	NA	31,099	75,797	NA	677,224	NA	3,307,458
2,587	NA	40,862	NA	159,916	3,294	NA	57,078	NA	237,299	1,737	NA	26,963	NA	114,564	51,575	NA	794,829	NA	2,963,585

*Wild and hatchery steelhead were not differentiated prior to 1990.

Table D-13. Summary of smolt monitoring sample numbers at Bonneville Dam, PH2, 1986-1998.

Year	Season Dates	Sampling Hours/Frequency	Sample Rate ^	**Chinook** Yearling	**Chinook** Subyearling	**Steelhead** Wild	**Steelhead** Hatchery	**Coho**	**Sockeye**	**Total Sample**
1986	3/4-11/25	24 / daily	0.1	10,917	16,844	*	1,494	6,112	2,599	37,966
1987	3/10-11/20	24 / 4 days/wk	0.1	6,461	5,438	*	823	3,940	642	17,304
1988	3/17-11/30	24 / daily	0.1	7,068	9,744	*	762	5,555	238	23,367
1989	3/17-11/30	24 / daily	0.1	15,579	12,197	*	2,049	9,192	2,247	41,264
1990	3/12-11/30	24 / daily	0.1	5,463	20,469	238	205	6,300	164	32,839
1991	3/15-11/30	24 / daily	0.1	18,372	19,050	952	1,630	8,070	2,592	50,666
1992	3/13-11/20	up to 7 / MWF	0.1	358	1,461	3	4	119	1	1,946
1993	3/17-11/24	up to 24 / MWF	0.1	5,468	5,545	255	462	3,621	624	15,975
1994	3/10-10/31	up to 24 / MWF	0.1	4,172	5,703	218	279	2,678	400	13,450
1995	3/11-10/31	up to 24 / MWF	0.1	2,709	4,696	65	183	1,075	355	9,083
1996	3/13-9/13	up to 24 / MWF	0.1	3,059	8,662	182	531	4,296	196	16,926
1997	4/27-9/5	up to 24 / MWF	1	1,311	7,415	461	1,596	2,169	520	13,472
1998	4/1-10/2	up to 24 / MWF	1	3355	5519	696	720	1303	711	12,304

^ Refers to sample rate during sample period, not entire day.

*Wild and hatchery steelhead were not differentiated prior to 1990.